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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 10 31 MARCH 1974 NUMBER 1

TURTLES AT THE BRINK: OUR ENDANGERED SPECIES

Howard W. Campbell

The history of life on our planet is marked by the rise and fall of animal groups and species; like the individual itself, species are born, live their lives, and then die. The cycle is overwhelmingly apparent at any level of life we wish to examine and extends as far back as we have any evidence. The few kinds of animals which have escaped, temporarily, this cycle are noteworthy for their rarity. The tuatara of New Zealand, extending back nearly unchanged 150 million years to the late Jurassic, has survived because of its isolation on islands and protection from competitors. Crocodilians have persisted since the late Triassic, or about 190 million years. Turtles, as a class, may hold the longevity record for reptiles with an ancestry that goes back some 210 million years to the early Triassic period. Many turtle species have come and gone in this span of time, of course, some ending their lines, others evolving into others which continued on to replace them in the temporal unfolding of the evolutionary sequence. Extinction of type is the usual and natural consequence of the evolutionary process; extinction, in fact, could be considered the inevitable fate for species as death is for the individual.

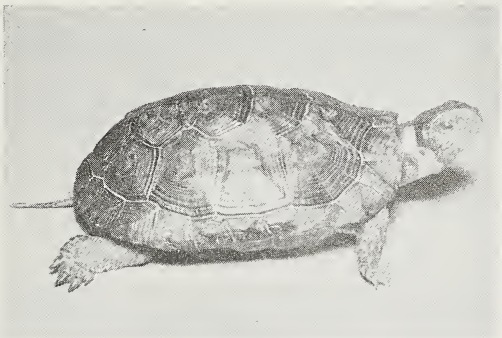

Figure 1. Clemmys muhlenburgi, the Bog turtle, occurs, as its name implies in small colonies in isolated bogs from Connecticut to North Carolina. These rare habitats are rapidly being drained and destroyed for agriculture and urbanization. A flourishing pet trade further compounds this species' problems.

Why then, should we be so concerned about the species today which teeter on this brink? Is an "Endangered Species" of today of greater concern than the thousands which have suffered this fate over the eons of geologic time? Our own awareness and concern, of course, add a new dimension to the problems of extinction. We may simply be disturbed to lose a bit of diversity and diversion in our environment. But beyond this, the species we are losing today are not leaving their heritage in new and unique strains as did so many of the past species. They represent the termination, the end, of unique genetic lines. And this is occurring at an alarming rate. Each species that is lost takes with it a wealth of

information about the functioning of ecosystems, the adaptive and evolutionary processes. As we go blithly along altering our environment and eliminating its components we move further away from a basic understanding of how it all worked before we began to tamper. And the farther we get, the more difficult it will be to put it all back together again when (not if!) we accept our own ecological role and recognize that we must have a healthy ecosystem to have a tolerable human environment.

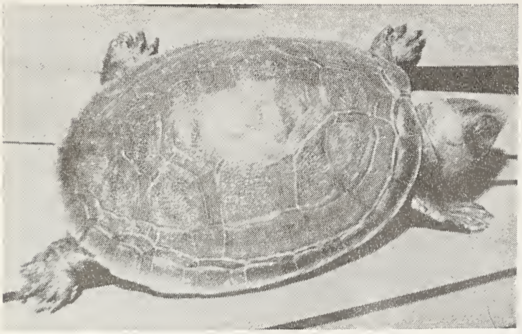

Figure 2. Podocnemis cayennensis, a little known River turtle from South America, is now protected by the International Convention in Trade.

Habitat lost to humans uses, pollution of remaining habitats, and direct economic exploitation for products and the pet industry all take their toll. Some of this is inevitable; human beings and their necessary support facilities take space and the space used for a house or gas station or highway can not also serve as turtle habitat. The rabbit-like proliferation of human bodies must be accommodated until effective controls can be developed; we will continue to see more habitat lost to satisfy the simple need for human-space. Wise and ecologically based land-use planning can minimize, but not eliminate, this pressure on our wildlife populations.

Figure 3. The Hawksbill turtle, Caretta caretta, supplies the jewelry industry with "tortoiseshell". This market is rapidly driving the species to extinction.

The habitat lost to human-use is actually small compared to that befouled by our pollutants. Pollution is an enormously expensive luxury that any ecologically sane society cannot and will not long subsidize. When the true ecological economics of pollution are fully appreciated, we can expect that this problem will be brought under control. Present efforts may be too-little but we hope not too-late. It takes only money and the cost, though great in dollars, is insignificant for such a gain.

Economic exploitation is an area in which we turtle fanciers must accept our share of the blame. While most animal species' populations can tolerate, and many even require, some human predation in the simplified ecosystems we create, those in the "endangered" category cannot. Yet the very fact of a species' perilous state and low numbers may often increase the demand on it for pet specimens or on its products by the more selfish among us. The rarer a species becomes the more it is desired,

a phenomena I call the "rare species spiral". Anyone who participates in this deadly game bears full responsibility for the steadily growing list of species in the endangered category. We must put our own houses and priorities in order before we can exert any real pressure on others to order theirs.

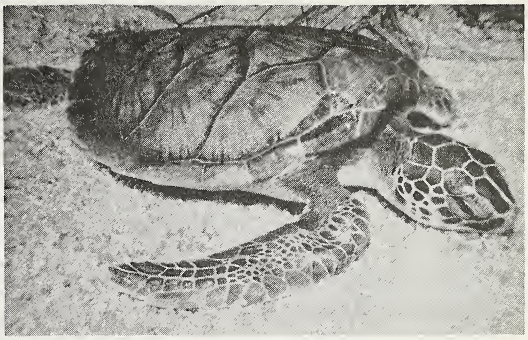

Figure 4. The Green sea turtle, Chelonia mydas, the gourmet's favorite for turtle soup and steak, is declining seriously throughout the world.

The pressures are growing, however, and some positive responses are becoming effective. One of the initial steps has been the evaluation of the status of the many species to determine which should be considered endangered. There were, and are, many problems associated with such a seemingly simple process. Agreement must be reached on just what condition a species must be in to deserve such special attention and what sort of information is required to make such decisions. Adequate standards and procedures are not yet available and there is disagreement between and within the various agencies which are concerned with this problem. There is also the question of just what to do about a species which is considered to be endangered, especially economically valuable species. If we offer it total protection we are playing with some individual's economic livelihood and the more valuable the species, the greater the political pressures associated with removing it from the market. There are many problems that must be resolved before we develop an effective and equitable program. But the initial steps are being taken and already lists of species in the endangered category are available. The International Union for Conservation of Nature and Natural Resources (IUCN) has produced its influential "Red Book" of endangered and rare species; several turtle species appear in this list. The Bureau of Sport Fisheries and Wildlife of our Department of the Interior has created the Office of Endangered Species to deal with these problems and has noted a number of turtle species in its list of rare and endangered species. The states now are beginning to respond also and several state lists have been prepared. Much more effort at the state level is desperately needed. More thought at the state level on the basic philosophical question of the determination of consistent standards for evaluating species' populations is also needed. As lists proliferate the inconsistencies may magnify if

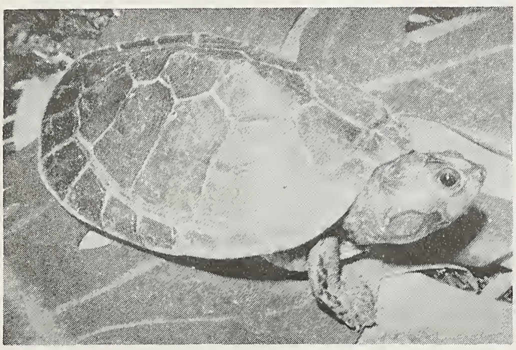

Figure 5. The Arrau, or South American River turtle, Podocnemis expansa, is heavily exploited for meat, eggs, and the pet trade. It rates strong protection under all current laws but is still exploited in its native habitat.

care is not taken to develop a consistent philosophy. There may be various levels of "endangered" which should be recognized, for example. Perhaps we should differentiate between species which are virtually extinct throughout their range and those facing extirpation within one state's borders but which are abundant elsewhere. Or the opposite case, where a species is in serious trouble throughout most of its range, but locally abundant within one state's borders. Should this state recognize the overall condition of the species in its decision or should it confine its evaluation to its own political boundaries? What should be a reasonable state decision when a species is abundant in one section but is being rapidly eliminated over the other areas? These are all critical issues which should be resolved now before we are burdened with a maze of contradictory decisions at the local levels. Higher level decisions should be based on the local analyses but only if there is some uniformity in these compilations.

What species of turtles are in the most serious condition? The IUCN has published a list indicating which species are protected in various countries. The IUCN Red Book, vol. III, lists the following species (taken from Special Supplement to IUCN Bulletin *3* (6), June 1972, compiled by R. Honegger). Number in brackets indicates the number of countries in which the species occurs.

Batagur baska, River terrapin [12]
Pseudemydura umbrina, Short-necked turtle [1]
Malacocherus tornieri, Pancake tortoise [2]
Pyxis arachnoides, Madagascar spider turtle [1]
Testudo g. graeca, Mediterranean spur-thighed tortoise [5]
Testudo radiata, Radiated tortoise [1]
Testudo planicauda, Madagascar flat-shelled tortoise [1]
Testudo yniphora, Madagascar tortoise [1]
Testudo geometrica, Geometric tortoise [1]
Terrapene coahuila, Aquatic box turtle [1]
Gopherus polyphemus agassizii, Western gopher tortoise [2]
Gopherus polyphemis berlanderi, Berlandier's gopher tortoise [2]
Gopherus polyphemis flavomarginatus, Mexican giant gopher tortoise [1]
Clemmys muhlenbergii, Bog turtle [1]
Podocnemis madagascariensis, Madagascar greaved tortoise [1]
Podocnemis cayennensis, Red-headed Amazon turtle [5]
Podocnemis dumeriliana, Giant river turtle [4]
Podocnemis expansa, Arrau turtle [3]
Podocnemis sextuberculata, Yellow-headed side-necked turtle [1]
Podocnemis unifilis, Terecay turtle [6]
Podocnemis lewyana, Magdalena River turtle [2]
Podocnemis vogli, Orinoco greaved turtle [1]
Pseudemys ornata callirostris, South American red-lined turtle [2]
Caretta caretta, Loggerhead turtle
Chelonia mydas, Green turtle
Chelonia depressus, Flatback green turtle
Eretmochelys imbricata, Hawksbill turtle
Lepidochelys kempii, Kemp's ridley turtle
Lepidochelys olivacea, Olive ridley turtle
Dermochelys coriacea, Leathery turtle
Testudo elephantopus, Galapagos tortoise (13 subspecies)

The U. S. Department of Interior has listed the following foreign species in the Federal Register as of May 19, 1972:

> *Testudo elephantopus,* Galapagos tortoise
> *Testudo radiata,* Madascar radiated tortoise
> *Eretmochelys imbricata,* Hawksbill turtle
> *Lepidochelys kempii,* Atlantic ridley turtle
> *Dermochelys coriacea,* Leatherback turtle
> *Podocnemis expansa,* South American river turtle
> *Podocnemis unifilis,* South American river turtle
> *Pseudemydura umbrina,* Short-necked or swamp tortoise

On January 17, 1973 (Dept. Interior News Release) the Secretary of the Interior, Rogers Morton, proposed the addition of *Terrapene coahuila,* the Aquatic box turtle, to this list.

In the 1968 edition of Rare and Endangered Fish and Wildlife of the United States, Resource Pub. #34, Bur. Sports Fisheries and Wildlife of the Department of the Interior, no turtles were listed as endangered. The Bog turtle, *Clemmys muhlenbergi*, was listed as rare, and the Desert tortoise, *Gopherus agassizi*, was listed as status indeterminate, that is, requiring additional information.

Few state lists are yet available. California has prepared a list of its rare and endangered species and placed no turtles on the list although the Gopher tortoise, *Gopherus agassizi* is fully protected in the state. Maryland has placed the Bog turtle (*Clemmys muhlenbergi*) and all species of marine turtles which frequent its waters on its state list and New Jersey lists the Bog, Wood (*Clemmys insculpta*), and Eastern spiny softshell (*Trionyx s. spiniferus*) as rare. Ohio, Pennsylvania, Texas, Florida, and Virginia, among others, are currently preparing or considering their own lists of endangered species and their decisions are not yet available.

An International Treaty on Trade in Endangered Species of Wild Fauna and Flora has recently been signed in Washington, D.C. This is perhaps the most significant piece of legislation to date and extends wide protection to the species fortunate enough to be covered by its provisions. While we can grieve over their unfortunate status, we should be happy to note that several species of turtles are now protected by this legislation. To summarize the treaty very briefly, two categories of species have been defined, Category I for those in most serious straits and Category II for those which require less stringent protection but are in need of some regulation. The first category, those considered most endangered, contains several species of turtles. Both the Atlantic ridley turtle (*Lepidochelys kempii*) and Atlantic Hawksbill turtle (*Eretomochelys imbricata imbricata*) are in this category as are all populations of the Galapagos tortoise (*Geochelone elephantopus*). Others in this category include:

> *Batagur baska,* River terrapin
> *Geoclemys hamiltoni,* Black pond turtle
> *Kachuga tecta tecta,* Roofed turtle
> *Geomyda* (previously *Nicoria*) *tricarinata*
> *Lissemys punctata punctata,* Indian soft-shell turtle

Trionyx ater, Cuatro Cienegas soft-shell turtle
Trionyx nigricans
Trionyx gangeticus, Ganges soft-shell turtle
Trionyx hurum
Morenia ocellata, Burma pond turtle
Pseudemydura umbrina, Short-necked turtle
Terrapene coahuila, Aquatic box turtle
Psammobates geometricus, Geometric tortoise
Geochelone radiata, Radiated tortoise
Geochelone yniphora, Madagascar tortoise

All commerce in these species requires both an export permit from the country of origin and an import permit for the country for which they are destined. These permits can be issued only after responsible scientists have judged that the removal of the specimens will cause no serious damage to the populations.

Species in Category II require only an export permit from their country of origin. The turtle species which fall into this classification are all tortoises, that is, members of the family Testudinidae, except those already listed in Category I. This includes all species of the genera *Homopus*, *Kinixys*, *Pyxis*, *Acinixys*, *Malacochersus*, *Gopherus*, *Psammobates*, *Chersina*, *Testudo*, and *Geochelone*. Also listed are all species of the genus *Podocnemis*, the river turtles, all sea turtles not included in Category I and *Clemmys muhlenbergi*, the Bog turtle.

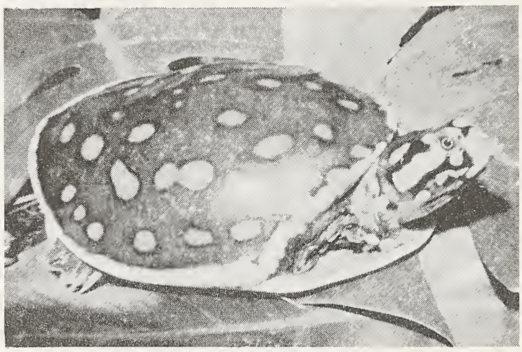

Figure 6. The Indian soft-shelled turtle, Lissemys punctata, found only in India and Ceylon. This subspecies (L. p. punctata) is found only in the Indus and Ganges River systems.

This is certainly an impressive listing and the implemention of the provisions of this treaty will be a major step in the direction of salvation for many species! The treaty has been agreed to by a total of 80 nations and awaits only ratification by the respective governments. All told this treaty will essentially ban all trade in 375 species or genera of animals and plants and will regulate trade in another 250. The operation of the permit system will be monitored by the United Nations' newly formed environmental secretariat under Maurice E. Strong. We can hope for an early ratification and implementation of this legislation!

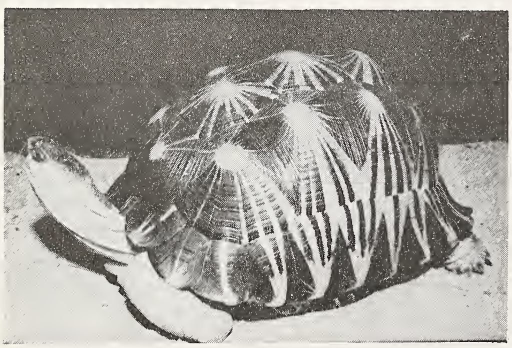

Figure 7. Geochelone radiata, Madagascar's Radiated tortoise, reaches a weight of up to 15 pounds and brings high prices in the pet trade. It is now protected on all the recognized lists.

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PARASITES OF REPTILES: PART II
DIGENETIC TREMATODES INHABITING THE RESPIRATORY AND UPPER DIGESTIVE TRACTS OF SNAKES

Richard Franz

This paper represents the second in a series dealing with reptilian parasites. The first, entitles "Parasites of Reptiles (Part one: Tapeworms)" appeared in 1972. It is not the intention of the author, as previously stated (Franz, 1972), to include new information but rather to review the available literature. This report concerns those trematodes which normally inhabit the mouth, esophagus, trachea, and lung of North American snakes (occasionally, these flukes will also inhabit other organs).

Trematodes, commonly known as flukes, belong to the same phylum as tapeworms and planarians (phylum Platyhelminthes). Though quite variable in morphology, flukes may generally be distinguished from the other members of the phylum by their short, flattened bodies and well-developed digestive tracts. All members of this class are parasites. The group is divided into three subclasses - - - Monogenea, Aspidogastrea, and Digenea. The Monogenea (monogenetic trematodes) are primarily ectoparasites of fishes. Members of the second subclass, Aspidogastrea, are endoparasites of fresh-water mussels, some fishes, and turtles. Both of these groups usually require only a single host to complete their life cycle. The third and largest subclass, Digenea (digenetic trematodes), are internal parasites of vertebrates and are characterized by having one or two suckers, a digestive tube having two blind internal sacs, and a complex life cycle involving at least one intermediate host in addition to the definitive host.

According to Schell (1970), there are 69 families of digenetic trematodes, but only two (Plagiorchiidae and Ochetosomatidae) commonly infect the respiratory and upper digestive tracts of North American snakes (Table 1). In regions other than North America, other families and genera inhabit these anatomical areas (Table 2). Flukes in their host may appear as tiny dark spots in the mouth, esophagus, trachea, or lung. The family Plagiorchiidae contains 11 genera but only one, *Stomatrema*, frequents the anatomical region under study. The other family, Ochetosomatidae, contains 7 genera and 33 species all of which occur in this region. These two families differ mainly in the position of the main collecting ducts of the excretory vesicles. In the Plagiorchiidae the ducts are attached to

Table I

A list of the genera and species of flukes commonly inhabiting the respiratory and digestive tracts of snakes with notes on the hosts and geographic distributions. The list is modified from Byrd and Denton, 1938; Dubois and Mahon, 1959; Yamaguti, 1971; unpublished species list of S.R. Telford. The list represents an attempt of the author to summarize the available information and, no doubt, contains omissions and errors.

Family Ochetosomatidae

genus *Dasymetra*
1. *D. conferta* Nicoll, 1911 - *Natrix*; N.A.
2. *D. longicirrus* (Odlaug, 1938) - *Natrix, Thamnophis*; N.S.
3. *D. natricis* (Holl and Allison, 1935) - syn. *D. nicolli* - *Natrix*: N.A.
4. *D. villicaeca* Byrd, 1935 - *Natrix*; N.A.

genus *Lechriorchis*
5. *L. insignis* Parker, 1941 - *Thamnophis*; N.A.
6. *L. megasorchis* Crow, 1913 - *Natrix*; N.A.
7. *L. plesientera* Sumwalt, 1926 - *Thamnophis*; N.A.
8. *L. primus* Stafford, 1905 - *Thamnophis, Natrix*; N.A.
9. *L. proprius* (Nicoll, 1914) - *Thamnophis*; N.A.
10. *L. tygarti* Talbot, 1933 - *Thamnophis*; N.A.

genus *Natriodera*
11. *Natriodera verlatum* (Talbot, 1934) - *Natrix*; N.A.

genus *Ochetosoma*
12. *O. aniarum* (Leidy, 1891) syn. *acetabulare, orula, wardi, natricis, texanus* - *Natrix, Lampropeltis, Seminatrix, Heterodon, Agkistrodon*; N.A.
13. *O. bravoi* Brenes Madrigal and Arroyo Guido, 1960 - colubrid snake; Costa Rica
14. *O. brevicaecum* (Caballero, 1941) - *Thamnophis, Xenodon*; Mexico, Panama.
15. *O. elaphis* (Parker, 1941) - *Elaphe*; N.A.
16. *O. ellipticum* (Pratt, 1903) syn. *formosum, speticus, ophioboli, adenodermis* - *Bothrops, Clelia, Coniophanes, Drymarchon, Drymbius, Dryodophis, Erythrolamprus, Heterodon, Lampropeltis, Leptodeira, Leptophis, Micrurus, Pliocercus, Thamnophis, Xenodon, Zamenis*; N.A., C.A.
17. *O. elongatum* (Pratt, 1903) syn. *validus, inermis, abduscens, magnus, heterodontis, grandispinus* - *Drymarchon, Heterodon, Lampropeltis, Coluber*; N.A.
18. *O. heterocoelium* (Travassos, 1921) - *Lachesis, Bothrops*; S.A.
19. *O. kansensis* (Crow, 1913) syn. *georgianum, serpentis, elaphis, crotali, floridanum* - *Agkistrodon, Sistrurus, Diadophis, Heterodon*; N.A.
20. *O. lateriporus* (Stewart, 1960)- *Coluber*; N.A.
21. *O. laterotrema* (Byrd and Denton, 1938) - *Agkistrodon*; N.A.
22. *O. monstruosum* Braum, 1901 syn. *megametricus, miladelarocae, ancistrodontis* - *Erythrolamprus, Bothrops, Thamnophis*; C.A.
23. *O. sauromates* (Poirier, 1885) - *Elaphe*; Europe.
24. *O. validum* (Nicoll, 1911) syn. *inermis* - *Heterodon, Coluber, Drymarchon*; N.A.
25. *O. zschokkei* (Volz, 1899) syn. *heterodontis* - *Heterodon*; N.A.

genus *Paralechriorchis*
26. *P. bosci* (Cobbold, 1859) - *Coluber*; N.A.
27. *P. natricis* (Holl and Allison, 1935) syn. *L. secundus* - *Natrix*; N.A.
28. *P. syntomentera* (Sumwalt, 1926) - *Thamnophis*; N.A.

genus *Pneumatophilus*
29. *P. foliaformis* Talbot, 1934 - *Natrix*; N.A.
30. *P. leidyi* Byrd and Denton, 1937 - *Natrix*; N.A.
31. *P. variabilis* (Leidy, 1856) - *Thamnophis, Tropidonotus, Pseudemys, Natrix*; N.A.

genus *Zeugorchis*
32. *Z. aeguatus* Stafford, 1905 - *Thamnophis*; N.A.
33. *Z. eurinus* (Talbot, 1933) - *Thamnophis*; N.A.

Family Plagiorchiidae

genus *Stomatrema*
34. *S. faranciae* Parker, 1941 - *Farancia*; N.A.
35. *S. pusilla* Guberleti; 1928, syn. *guberleti* - *Farancia*; N.A.
36. *S. provitellaria* (Bennett, 1938) - *Farancia*; N.A.

TABLE 2

List of genera inhabiting the upper digestive and respiratory tracts of snakes outside of North America.

PARASITE	HABITAT	HOST	RANGE
Glossidiella	lung	*Eunectes, Cyclagras*	Brazil
Bieria	lung	*Liophis*	Brazil
Encyclometra	esophagus stomach	*Natrix*	Asia
Leptophallus	esophagus	*Natrix, Naja*	Europe, Africa
Metaleptophallus	esophagus	*Natrix*	probably Europe
Macrodera	lungs	*Natrix, Coluber*	Europe
Opisthogonimus	mouth	*Dryophylax, Liophis, Xenodon, Philodryas, Ophis, Bothrops, Chironius, Tomodon*	South America
Liophistrema	lung	*Liophis*	Brazil
Westella	esophagus	*Philodryas*	Brazil
Sticholecitha	esophagus	*Chironius*	Surinam
Glossidioides	lungs	*Eunectes, Cyclagras*	Brazil
Haplometroides	mouth	*Elaps (?), Rappia*	Paraguay (?), Liberia
Aliptrema	esophagus	*Liophis*	Brazil
Oesophagicola	esophagus stomach	*Laticauda*	Ryukyu Island

(compiled from Yamaguti.)

the distal ends of the vesicles, whereas in the Ochetosomatidae, they are attached laterally (Schell, 1970). I have found it much simpler to identify these animals directly to genus rather than to first classify them as to family. All eight genera found in the areas under discussion are distinct and are readily identified from either Schell's or the enclosed key (Figure 1).

Classification of the ochetosomatid flukes.

The literature dealing with the taxonomy of ochetosomatid flukes is still horribly confused. There is a great deal of disagreement between authorities concerning not only the validity of certain species' names but also the relationships among species, genera and families. As in most taxonomic groups there are "splitters" and "lumpers" creating or synonymizing new and old names. As an example, in 1902 Pratt established the subfamily Reniferinae in the family Plagiorchiidae for the ochetosomatid flukes. Later this subfamily was given familial status (Baer,1924) but then returned to the subfamily level by Mehra (1931). Today ochetosomatid flukes are again in their own family--the Ochetosomatidae. Generic names have also fluctuated. Price (1935, 1936) noted that genus *Zeugorchis* contained several species which were not congeneric with the type *Z. aeguatus*; for these he created the new genus *Pseudorenifer*. Byrd and Denton (1938), besides describing numerous new species, split the then-existing genera *Renifer* (today's genus *Ochetosoma*) into *Renifer* and *Neorenifer*, and *Lechriorchis* into *Lechoriorchis* and *Paralechriorchis*.

KEY TO THE DIGENETIC TREMATODA OF THE FAMILY OCHETOSOMATIDAE

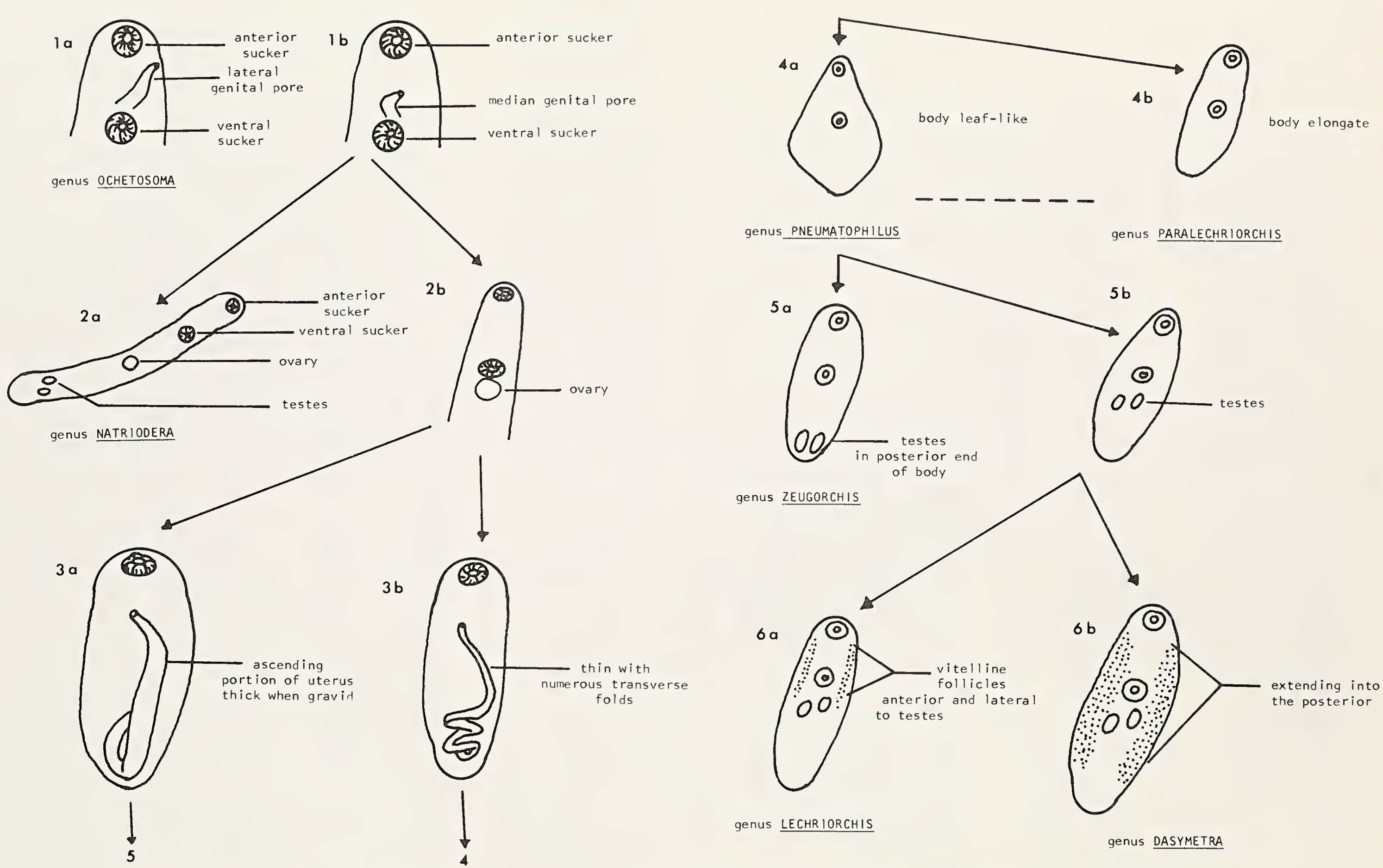

Figure 1. Illustrated key to the genera of flukes (family Ochetosomatidae) inhabiting the mouth, esophagus, trachea, lungs and occasionally other organs of snakes. Key is modified from Schell (1970).

They also felt that *Pseudorenifer* was conspecific with *Renifer ellipticus* and hence not valid. This is not a complete picture, as there were at least half a dozen or so other investigators who expressed their thoughts on the taxonomy of these flukes. Today, with the publication of Dubois and Mahon's paper (1959) and Schell's monograph (1970), we have a clearer idea of the species and genera alignments within this family. Nevertheless, the battles of splitters and lumpers still rage today. Hopefully with the new techniques available to the taxonomist (biochemistry and computer analysis) these problems will soon be solved, enabling the ecologist to discover what roles these unique parasites play not only in their internal environments but also in their external environment as well.

Preparation of Flukes for Study.

Flukes can be successfully gathered from the mouth of a living snake or from the mouth, esophagus, trachea, and lungs of a freshly killed specimen. Sharp-pointed forceps are suggested for collecting. Although dissections are usually made as soon as possible after the death of the host, they may be delayed up to 6 hours with refrigeration. Freezing or preserving snakes in formalin should be avoided if possible as these procedures often create problems. After freezing or preserving, the parasites are difficult to distinguish from pieces of tissue. Preservatives cause the flukes to die unrelaxed which results in distorted specimens. This may obscure the view of important organs necessary for identification.

After removing the worms from their hosts, place them in saline solution (0.7 percent sodium chloride) and freeze. After several hours in the freezer, remove and thaw slowly. Using this technique the worms die slowly and their bodies are relaxed. Preserve the worms in FAA. When you are ready to stain, rinse the parasites in distilled water. If a water-based stain is used, the parasites must be stained at this point; if an alcohol stain is used, it can be applied when the worms are in 70 percent ethanol. I recommend Semichones Carmine, an alcohol-based stain (see Franz, 1972 for precise directions in staining). After rinsing, the worms are dehydrated in ethanol solutions, stained, and cleared in oil of wintergreen, mounted on glass slides with Permount, dried, and labelled. A label should contain the following information: host name, collection site within host (mouth, lung), date of collection, collector, and stain used. You may also want to include a slide number and the identification of the parasite (if known). Do not place the slide vertically until the Permount is thoroughly dry (up to a week) or the worms will tend to drift together at the bottom of the cover glass. Specimens can be temporarily stored unmounted in oil of wintergreen.

Morphology of respiratory and upper digestive tract trematodes of snakes.

Digenetic trematodes are flattened dorso-ventrally and generally have oval to elongate bodies. Usually oral and ventral (acetabulum) suckers are present. Although superficially the internal anatomy appears quite different from one genus to the next, as a group, the digenetic trematodes are basically similar. Generally, there is an alimentary tract consisting of a mouth located in the anterior (oral) sucker, a muscular pharynx, a short esophagus, and two blind caeca. Adult worms feed on sloughed cells, lymph, blood, and organic debris present in the snake's mouth, esophagus,

trachea and lungs. Food passes from the mouth into the intestinal caeca where it is digested (Cheng, 1964). Some nutrients are also absorbed thru the tegument (Forrester, personal communication). Each worm contains both male and female reproductive organs. The position and shape of the single ovary, the two testes, the uterus, the genital pore and the vitellaria are important taxonomic characters.

Members of the family Ochetosomatidae are quite diverse in the structural arrangements and shapes of their organs. Various taxa are separated on the bases of length and shape of the uterus, length of the intestinal caeca, grouping of the vitellaria, size and shape of the two suckers, shape of the testes, and length of the cirrus sac. The largest genus, *Ochetosoma*, is distinguished from other related genera by its obvious lateral genital pore. *O. aniarum*, a common species in *Natrix* of north central Florida, is probably the most distinct species in the genus. Its vitellaria are divided into two fields (Figure 2a). Genus *Pneumatophilus*, one of the most

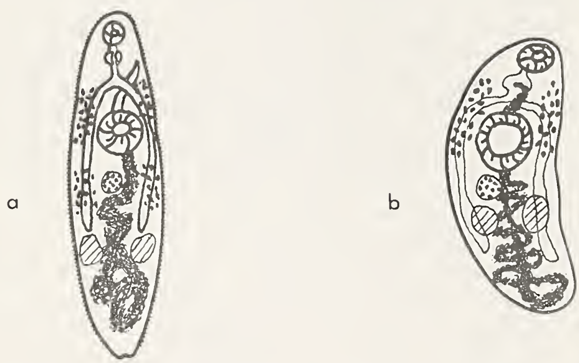

Figure 2. (a) *Ochetosoma aniarum* from the mouth of *Natrix cyclopion* (notice the divided vitelline follicles); (b) *Stomatrema pusilla* from *Faranicia abacura*.

unusually shaped members of the family, resides in the trachea and upper lung area. Its extremely flat and posteriorly-expanded, leaf-shaped body enables it to survive without impairing the respiration of the host. The genus has been divided into several species based on the shape of the testes and the relative position of the caeca. The monotypic *Natriodera*, another lung parasite, is also unusual in that the body is extremely elongate, and the testes are found in the rear of the worm. Other genera--including *Dasymetra*, *Lechriorchis*, *Paralechriorchis*, and *Zeugorchis*--are similar in general appearance but differ in the position of vitellaria and testes and in the thickness of the ascending uterus. *Zeugorchis* has testes in the posterior portions of the body; *Lechriorchis* and *Dasymetra* have thick uteri and *Paralechriorchis* a thin uterus. *Dasymetra* can be distinguished from *Lechriorchis* by the relative length of the vitellaria.

The genus *Stomatrema*, the only plagiorchiid genus found in the area under discussion, can be distinguished from all ochetosomatid genera by its anteriorly-located vitellaria and its thin, tightly-coiled uterus (Figure 2b). Also, it is apparently restricted to a single host, *Farancia*

abacura. *Pneumatophilus* cf. *variabilis* occur sympatrically with *Stomatrema*. Host specificity is apparently common among these flukes (Sogandares-Bernal and Grenier, 1972) and may be a useful device in eliminating many species possibilities.

Life Histories and Ecological Roles of Ochetosomatid and Plagiorchiid Trematodes in Snakes.

From the available information, it appears that snake trematodes of both families undergo similar developmental histories. McCoy (1928), investigating the life cycles of *Ochetosoma kansensis*, *Dasymetra conferta*, and *Pnematophilus variabilis* found that each species required three hosts--a snail of the genus *Physa* as its first intermediate host, a tadpole or catfish as its secondary larval host and, of course, the snake as its definitive or final host. In 1933, Talbot described the development of several species of *Lechriorchis*; later Byrd (1935) published an account of the life histories of *Ochetosoma aniarum* and *Dasymetra villicaeca*. In all cases both snails and tadpoles were required as intermediate hosts.

In order for the reader to fully appreciate the complexities of the life histories and the difficulties encountered in investigating them, I present Byrd's description (Byrd, 1935) of the life cycle of *Ochetosoma aniarum*. Byrd obtained numerous trematodes from the mouths of *Natrix sipedon*, *N. erthryogaster*, *N. rhombifer* and *N. cyclopion* collected around New Orleans. The worms, when placed in tap or distilled water, readily discharged their eggs. The eggs were fed to snails, *Physa* and *Pseudosuccinea*. They hatched within one hour after ingestion, usually in either the esophagus or "stomach" of the snail. The failure of the larvae to develop in the snail *Pseudosuccinea* indicated some degree of host-specificity. The newly-hatched larvae or miracidia (sing. miracidium) quickly penetrated the gut wall of the physid snails. Within two to five days the parasite, in the form of a young mother sporocyst, had entered the digestive gland. This stage required from 15 to 25 days to develop daughter sporocysts. From 12 to 20 additional days were required for the development of cercariae within the daughter sporocysts. The cercariae ruptured walls of the parent to escape and soon afterward entered the lymphatic system of the snail. Eventually the cercariae migrated to the snail's exterior and escaped through the mantle cavity. After emergence from the snail, the cercariae settled to the bottom of the aquarium (or pond) and waited for a suitable host. Cercariae swam by means of a whip-like tail and actively attempted to invade any object with which they came in contact. If this happened to be an animal having soft skin (a tadpole), penetration occurred within three to eight minutes. Once inside, the cercaria migrated into the deeper tissues and encysted; the cyst survived the tadpole's metamorphosis. The vertebrate host was then eaten by a snake. The snake's gastric juices, mixed with pancreatic juices, dissolved the cyst's wall and released the larval trematode. After remaining in the snake's duodenum for several days, the young fluke migrated up the alimentary canal to the mouth, the habitat of the adult. The entire cycle from egg to gravid adult took 35 days.

After reviewing the life cycle of these flukes, one wonders how any manage to survive these rigors. Nevertheless this group is particularly successful. At certain localities in northern Florida, every *Natrix*

cyclopion and *N. fasciata* examined was infected with from one to 300 worms of several different genera. Even with tremendous infections, the snakes appear healthy and unaffected.

Little information is available on the natural history of trematodes under field conditions. There is a tremendous potential for exciting research in this area. At this time there are no studies available which depict populational trends over the course of a year. A study of this type could be carried out entirely with snakes killed on highways across swamps and thereby eliminate yet another mass slaughter for scientific purposes. It might be interesting to compare infection rates and parasite seasonality among several snake species that occur side by side in the same swamp. A wealth of information could be gathered on not only the parasites but also the definitive hosts. Fat body and liver weight surveys, sex ratios, reproductive conditions, food types and age structure of the hosts could be recorded as well. In fact, one or more of these could affect the distribution of the parasites. For example, pregnancy and the associated hormonal changes in the host could play a role in regulating parasite populations. No one knows. From these beginnings, laboratory experiments might be initiated. By staining the mouth flukes with some vital stain, it might be conceivable to monitor individual movements within the mouth. Studies in host specificity at various levels (snail, tadpole, snake) would also be extremely rewarding. There is simply no end to the investigations which could be explored. The absence of any base line information leaves the field wide open for scientific studies.

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GROWTH AND FEEDING BEHAVIOR IN THE ENDEMIC FLORIDA SCRUB LIZARD, *SCELOPORUS WOODI* STEJNEGER

David S. Lee, John B. Funderburg and L. Richard Franz

Since Stejneger (1918) first described *Sceloporus woodi* the species has received little attention. Except for a brief characterization of its habits and habitat (Carr, 1940), and an elaboration of the taxonomic descriptions (Smith, 1946), the only new information on this lizard extended its range to the south and southwest of Stejneger's previously recorded localities (Barbour, 1919; Jones, 1927). Later accounts repeated and summarized the findings of these authors.

The data reported here on the growth of this lizard were obtained from populations occurring on the Lake Wales Ridge near Winter Haven, Polk County, Florida. Specimens used for growth data were marked by toe clipping. Our period of study extended from June 1965 to July 1968. In addition, between July 1963 and December 1967 fifty scrub lizards, from four selected localities, were collected in order to determine the feeding habits of this lizard. Small samples of juvenile and adult lizards (26-54 mm S-V length) were collected in such a manner as to evaluate seasonal fluctuation in food items. Lizards were preserved in 10% formaldehyde at the time of capture.

GROWTH

The recapture and multiple recapture of approximately 50% of 144 marked and released scrub lizards (from near Winter Haven, Polk Co.) which were being used for population and home range studies indicate that some individuals may achieve sexual maturity in one year. Preliminary data indicate that many June hatchlings were 30-35 mm SVL by fall and 35-40 mm by midwinter; at least some of the males of this group were sexually mature by the following summer. Females, and those young hatching after July, probably do not reproduce the following year. Figure 1. represents the SVL plotted against the months of collection for 144 captures in this population and home range study. Lines connecting plotted points indicate known growth of wild individuals.

The maximum size reached by this species is apparently 58 mm SVL. Sexually mature females ranged from 39-58 (46.8) mm SVL, males 40-55 (46.3) mm SVL.

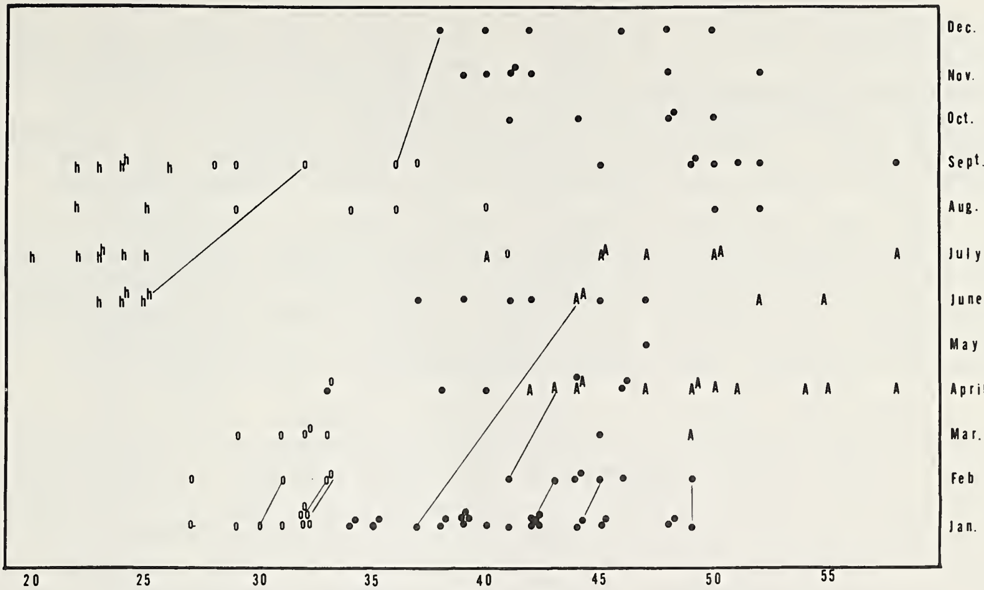

Fig. 1. Size distribution and growth based on 144 captures of S. woodi during 1967 and 1968 near Winter Haven, Polk Co., Florida. h = hatchling with umbulical scar still present. O = juvenile, ● = adult, A = adult in reproductive condition (i.e., females with shelled eggs, males with breeding colors and full sperm ducts). / = known growth of marked and recaptured individuals. Bottom scale represents SVL in mm.

FEEDING BEHAVIOR

Fifty lizards were examined for food items. There was an average of 13.9 items per lizard. Only one stomach was empty. No parasites were found in this sample, but parasitic nematodes were seen in several stomachs which were casually examined in 1964.

In order to determine possible variation in feeding behavior, four sample sites were selected. Two of these sampling sites (1/4 mi. S. Auburndale and 1/2 mi. SW of Jan Phyll Village, Polk County) were typical sand pine-rosemary scrubs, a habitat with which *S. woodi* has been characteristically associated. Here the plant communities were composed mostly of shrub-like *Quercus* (3 species), *Lyonia, Garberia, Serenoa,* and *Ceratiola*. Scattered Sand Pines (*Pinus clausa*) were not a dominant part of the plant community.

A third sampling site (1/2 mi. N. Pompano Beach, Broward County) was superfically similar to the ones mentioned above. This site was comparable to the Atlantic dune scrubs mentioned by Lee and Funderburg (1970) These scrubs were formed on old inland pleistocene Pamlico beach dunes. It should be pointed out that the term "dune scrub" is not intended to imply a salt resistant plant community associated with active beach dunes. At this site *Pinus clausa* was the dominant plant and dense stands of these trees allowed for little understory except in peripheral areas, and in places which had been partially cleared. Most scrub lizard activity was confined to these zones.

The fourth sampling site (2.5 mi. E. Lake Hamilton, Polk County) was in a sandhill habitat. Here many of the scrub index plants were lacking or existed only in small number. Oaks (*Q. laevis* and *Q. geminata*) and widely scattered long leaf pine (*P. palustris*) formed the overstory. The ground remained relatively free of herbaceous growth due to frequent ground fires. Clumps of saw palmetto (*Serenoa repens*) and wire grass (*Aristida stricta*) were sporadically distributed through the area.

At the first three sites, *S. woodi* appeared to be terrestrial in its foraging activities although occasional lizards were seen climbing on trees 2-5 feet above the ground. At the fourth site lizards appeared to be much more arboreal. Scrub lizards were frequently observed basking and feeding several feet above the ground on the trunks of oaks. Only on a few occasions were lizards encountered on the ground.

Sceloporus woodi is an opportunistic feeder. Prey, even in the Lake Hamilton specimens, consisted mostly of ground dwelling arthropods (ants, short-horned grasshoppers, cutworms, spiders, ground beetles, dung beetles, etc. See table 1). Although there may be differences in the insects at the generic or species levels, no obvious differences were noted in the type of food items from any of the sample sites. Ants (72.1%), short-horned grasshoppers (2.6%) and lepidopteran larvae (2.1%) were the most abundant prey at all four collection sites.

Specimens were collected during all four seasons (21 spring, 9 summer, 16 fall, 4 winter). We noted little seasonal change in feeding except for a slightly smaller variety of prey species in winter. There were fewer ants in the stomachs of lizards collected during the winter (62% of total food items) compared to summer specimens (75%). Both of these observations may be due to the small sample size.

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Table 1: Food items of 50 Sceloporus woodi.

	# of food items	% of food items	# of stomachs	% of stomachs
Insecta				
Coleoptera				
Carabidae	11	1.6	8	16
Cerambycidae	4	.6	2	4
Chrysomelidae	3	.4	2	4
Curculionidae	5	.7	3	6
Elateridae	1	.1	1	2
Scarabaeidae	11	1.6	7	14
Dermaptera				
Forficulidae	4	.6	1	2
Diptera				
Syrphidae	3	.4	3	6
Hemiptera				
Miridae	7	1.0	4	8
Pentatomidae	2	.3	1	2
Homoptera				
Cicadellidae	9	1.3	4	8
Cercopidae	1	.1	1	2
Hymenoptera				
Diprionidae	3	.4	3	6
Formicidae	504	72.1	40	80
Isoptera				
Kalotrrmitidae	23	3.3	1	2
Lepidoptera				
(Larvae)	15	2.2	10	20
Odonata				
Libellulidae	1	.1	1	2
Orthoptera				
Acrididae	18	2.6	8	16
Arachnida				
Araneida	12	1.7	9	18
Chelonethida	1	.1	1	2
Indistinguishable	61	8.7	12	24
Total	699	99.9	///	///

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The Possible Role of Fire on Population Density of the Florida Scrub Lizard, *Sceloporus woodi* Stejneger

As part of a long-term investigation on the life history of the endemic Florida scrub lizard, *Sceloporus woodi* (Lee and Funderburg, 1970; Lee, Funderburg and Franz, 1974) populations at several selected localities were intensively studied. One unexpected outcome of these studies is the data presented here on the possible effect of fire on the population size of these lizards.

AREA OF STUDY

The most dramatic evidence of the role of fire was observed in a ten acre study plot near Lake Hamilton, Polk County, Florida. Information presented here will pertain to this particular locality, unless otherwise stated. The site is a sandhill habitat where most of the scrub index plants are lacking, or, exist only in small numbers. Spanish moss (*Tillandsia usneoides*) covered oaks (*Quercus laevis* and *Q. geminata*) and widely-scattered long leaf pine (*Pinus palustris*) form the overstory. Because of periodic ground fires the ground normally remains relatively free of herbaceous growth and debris. Clumps of prickly pear cactus (*Opuntia* sp.), saw palmetto (*Serenoa repens*), and wire grass (*Aristida stricta*) are sporadically distributed throughout the area. The terrestrial vertebrate fauna of the area is diverse because of the ecotonal nature of the community. Species with wide ecological tolerances as well as those characteristicly associated with both pine flatwoods and sand pine-rosemary scrubs, are found here.

This particular locality was originally selected as a study area because of its unusually large population of *Sceloporus*. In the spring of 1964, when I first visited the area, it was not uncommon to see 20 or more adult scrub lizards in a single hour. In the winter of 1967-1968 I began a territorial, home range, and growth study of the lizards in this area, using a mark-recapture system. Population estimates, (Lincoln Index; Lincoln, 1930) made from data gathered at this time, indicated 10 to 23 (14.3) adult and sub adult lizards per acre. In late March of 1968, a fire removed all of the ground vegetation and other cover, and scorched and killed many of the smaller oaks. A census of the lizards in late April of the same year showed the species still to be numerous, although population sizes were difficult to estimate, since nearly all of the lizards had shifted their home ranges and many unmarked adults were believed to have come from areas outside established study plots.

METHODS

Data presented in fig. 1 represents information accumulated from field noted and collections made between 1965 and 1971. The month of April is one of the best for observing scrub lizard activity and was the month for which I seem to have the most complete records (the 1965 data

was from June). Therefore, all data presented apply to that month. It should be pointed out that fig. 1 represents only observed activity. It may not represent true relative population size. However I believe that over all population trends are illustrated inspite of several variables which were not taken into account. Observations were made between 9:30-11:00 a.m. and 2:30-4:30 p.m., times in which spring temperatures appear to stimulate maximum activity. All data was obtained on sunny days when there was little or no wind. Air temperatures ranged from approximately 25 to 30° C. Again, this represents conditions of optimum activity. All points plotted in fig. 1 represent averages of 8 to 22 field hours.

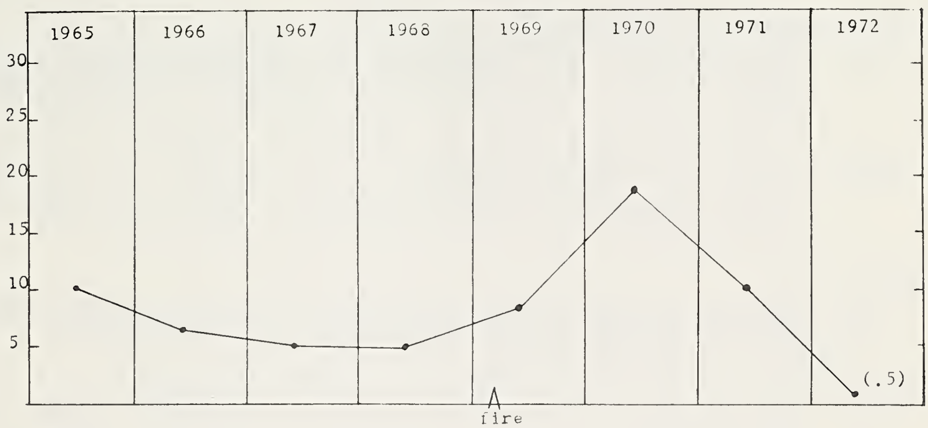

Fig. 1. Observed population variations of S. woodi 1965-1972. Vertical axis represents average number of adult S. woodi observed per man-field hour in Lake Hamilton (Polk Co., Fla.) study plot. Dates of earlier fires in this area are not known, but photographs taken in 1964 showed relatively little ground cover.

DISCUSSION

The accumulation of leaf-litter and other debris, along with in-increasing growth of *Aristida, Andropogon* and other grasses, has a detrimental effect on populations of *S. woodi*. In 1972, when the grasses had achieved their maximum observed growth, these lizards were all but absent from the community.

I suspect that healthy populations of *Sceloporus woodi* demand habitats relatively clear of ground cover. I have also noted scrub lizard populations in citrus groves. These lizards were only associated with young groves that are frequently disked (a method of removing ground vegetation). Older groves produce a solid canopy and probably would not provide enough sunning sites. In one case, I was aware of a small grove which had not been disked for over a year. Here the *S. woodi* population, which I had observed the previous two years, was no longer present. In well-estab-

lished pine-rosemary scrubs, the classic habitat for *S. woodi*, the vegatation often becomes so dense that the lizards are only encountered in peripheral areas. Telford (1959) noticed a similar local distribution of *Neoseps reynoldsi*, another central Florida endemic.

I would conclude that *S. woodi* favors open areas; in certain plant communities fire may be an essential tool for maintaining these conditions. In habitats where the debris and ground vegetation becomes too dense, the population suffers.

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Agonistic Behavior of the Eastern Mud Turtle *Kinosternon subrubrum subrubrum*

The Eastern Mud Turtle, *Kinosternon subrubrum subrubrum*, is common to the marshes and swamps of southern Maryland. While collecting in a small swamp in Charles County, Maryland, two eastern mud turtles were observed displaying agonistic behavior. The sky was clear and water temperature approximately 75° F. The observation took place 14 June 1973. The water averaged 3.5 cm deep and the bottom was soft mud and free of vegetation. The display took place in a shaded area under large maple trees. When first observed, the two turtles were pushing each other back and forth in a head to head orientation. The back and forth movement ranged from

several cm to about 50 cm. After 10 minutes, one turtle reversed direction and began moving away from the area. The second turtle immediately gave chase and grasped the fleeing turtle by the left hind leg. Both remained still for about 5 minutes. At this point, the fleeing turtle appeared to struggle and both turtles moved slowly forward for an additional 10 minutes. They then separated and the fleeing turtle continued moving away. Both were captured and it was discovered that the fleeing turtle had its left hind leg amputated at the knee joint. The attacking turtle retained the severed limb in its mouth. Neither turtle raised its head to breathe during the encounter. Both turtles were released. The sex of the turtles was not recorded.

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Chronological Herpetological Bibliography of Laurence Monroe Klauber from 1924 to 1972

This bibliography encompasses all of the published herpetological contributions of L.M.Klauber (1882-1968) from 1924 to 1972. It includes all titles noted by Grant (1945) in his bibliography of 73 titles for Klauber from 1924 to 1945. No new ones for that period are added here, but the list is completed with a total of 113 items. Two titles, "Classification, Distribution, and Biology of the Venomous Snakes of Northern Mexico, The United States, and Canada: *Crotalus* and *Sistrurus*" (1971), and "Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind" 2nd Edition (1972), were published posthumously.

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Snakes of Northwestern Pennsylvania

A rich herpetofauna, perhaps due to a great diversity of habitats and an abundance of moisture, exists in northwestern Pennsylvania. We are unaware of recent publications on snakes of this region and thus have studied the occurrence of these reptiles.

About 70 daytime collecting trips were made in Erie County between May 1971 and August 1973. Most trips were to the Howard Eaton Reservoir-Bull Dam, Behrend College campus, and Presque Isle State Park areas. All specimens were collected by hand. The identity, length, weight, state of health, and habitat of each snake were recorded. Most snakes were then marked and released.

One hundred and ninty specimens comprising nine species were collected as follows: (a) eastern garter snake, *Thamnophis s. sirtalis*; (b) northern brown snake, *Storeria d. dekayi*; (c) northern water snake, *Natrix s. sipedon*; (d) eastern milk snake, *Lampropeltis t. triangulum*; (e) northern red-bellied snake, *Storeria o. occipitomaculata*; (f) eastern ribbon snake, *Thamnophis s. sauritus*; (g) northern ringneck snake, *Diadophis p. edwardsii*; (h) eastern smooth green snake, *Opheodrys v. vernalis*; (i) queen snake, *Regina s. septemvittata*. The numbers and dimensions of these specimens appear in Table 1 while the habitats, usually in rather close proximity to streams, ponds, or marshes were several types of habitats adjoined, appear in Table 2. All snakes observed were captured with exception of eight northern water snakes and several eastern garter snakes.

Table 1: Numbers and dimensions of snakes collected in northwestern Pennsylvania

Species	No.	Length (cm)		Wt. (g)	
T. s. sirtalis	93	49[a]	16-73[b]	41[a]	20-161[b]
S. d. dekayi	42	28	13-38	8	1-22
N. s. sipedon	15	57	30-106	99	6-544
L. t. triangulum	17	49	23-91	42	3-190
S. o. occipitomaculata	10	30	25-35	8	27-39
T. s. sauritus	5	70	42-96	57	9-120
D. p. edwardsii	6	35	18-42	9	2-16
O. v. vernalis	1	38		8	
R. s. septemvittata	1	35		8	

[a] Avg.
[b] Range

Table 2: Habitats of snakes collected in northwestern Pennsylvania

	No. in each habitat type										
Species	A	B	C	D	E	F	G	H	I	J	K
T. s. sirtalis	19	4	18	1	1	8	36	0	5	0	1
S. d. dekayi	29	0	0	0	0	1	10	1	1	0	0
N. s. sipedon	3	0	0	9	0	0	0	1	0	0	2
L. t. triangulum	11	1	0	0	0	0	0	1	4	0	0
S. o. occipitomaculata	4	3	3	0	0	0	0	0	0	0	0
T. s. sauritus	0	0	0	0	0	5	0	0	0	0	0
D. p. edwardsii	2	3	0	0	0	0	0	0	0	1	0
O. v. vernalis	0	0	0	0	0	0	0	0	1	0	0
R. s. septemvittata	not recorded										

A under rock, plank, or bark in overgrown field.
B under bark on dead forest tree
C on woodland trail or clearing
D swimming in pond or stream (or under/on rocks at edge)
E on dirt road
F on grassy sandy lake shore
G on grassy sandy plain near lake (some specimens found under boards)
H on or under bark on dead trees in swamp
I lawn
J under dead leaves in woods
K on large rocks of dam

All specimens appeared healthy. Occasionally minor skin lesions, scars, or absence of tails were noted. The eastern garter snakes, northern water snakes, and eastern milk snakes often attempted to bite when captured. The northern red-bellied snakes, upon capture, lifted

the upper labials and laterally exerted the teeth of the upper jaw as described by Wright and Wright (1957). The other species collected did not display aggressive behavior.

All species collected in our survey are reported for northwestern Pennsylvania in recently published distribution summaries and the lengths and habitats of our specimens are within normal limits (Barbour, 1971; Cochran and Goin, 1970).

The following species, reported for northwestern Pennsylvania (Barbour, 1971; Cochran and Goin, 1970), were not observed: eastern hognose snake, *Heterodon platyrhinos*; black rat snake, *Elaphe o. obsoleta*; northern black racer, *Coluber c. constrictor*. Perhaps these species are either uncommon or exist in isolated pockets in our locality.

Presque Isle State Park, a 3100 acre peninsula which extends into Lake Erie, yielded only eastern garter snakes (in abundance), northern brown snakes, and eastern ribbon snakes. This area, composed of ponds, marshes, sandy plains, and forests, offers ideal habitats for the nine species observed in this survey. The reason for the apparent scarcity of different species on this peninsula was not determined.

The donation of specimens to this survey by the students and staff of Behrend College is greatly appreciated.

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A Note on Cannibalism in Corn Snakes, *Elaphe guttata guttata*

On 19 May 1973, a female corn snake, *Elaphe guttata guttata*, 89 cm in length, was collected near Cape Henlopen State Park, Delaware. On 12 June 1973 the snake laid ten eggs, all of which hatched during the period of 23 to 24 August. Five of the hatchlings were returned to the Cape Henlopen State Park area and released.

Three of the hatchlings were kept together in the same cage. They spontaneously ate infant mice, *Plethodon cinereus cinereus, Anolis carolinensis carolinensis, Lygosoma laterale, Sceloporus undulatus hyacinthinus and Eumeces fasciatus.*

Just after feeding on 9 October 1973, one of the young snakes was found attempting to swallow a cage mate. Only the head had been swallowed, so they were manually separated and each was apparently unharmed. On 22 October six days after having been fed, one of the snakes consumed a co-hatchling. The swallowed snake was not regurgitated, but digested normally. Both snakes measured 30 cm in length prior to the consumption. One of the snakes from this clutch is catalogued R 1802 NHSM in the collection of the Natural History Society of Maryland.

Young rat snakes are known to eat a large variety of food items, but cannibalism is uncommon. It must be taken into account that the snakes were confined in captivity, as an incident like this might not happen in nature.

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A New County Record for the Four-Toed Salamander, *Hemidactylium scutatum*, in Maryland

During the summer of 1969, Paul Bystrak and Walter J. Nixon collected a specimen of the four-toed salamander, *Hemidactylium scutatum* from within a rotting log just off of Md. Rt. 662, 3 mi. S of Wye Mills, Talbot County, Maryland. This specimen was released and would have represented a new county record had it been preserved in a Museum collection.

On 12 March 1973, Paul Bystrak and I attempted to obtain additional specimens at the above locality. Four gravid female *Hemidactylium* were found in a seepage area hiding under heavy growths of liverwort (Fig. 1). Apparently the salamanders were utilizing this habitat as a substitute for sphagnum which was stunted and scarce in this area. Two specimens are now catalogued A 2773-4 NHSM in the collection of the Natural History Society of Maryland. According to Harris (1969), these specimens represent a new county record for this species in Talbot County.

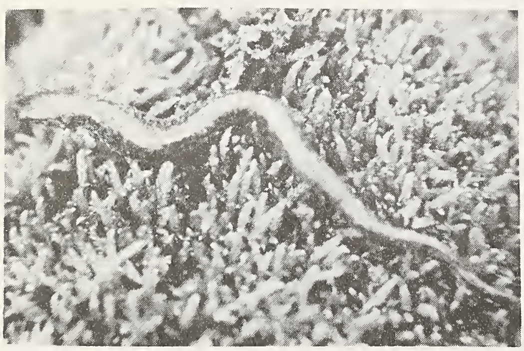

Fig. 1. A Four-toed Salamander, *Hemidactylium scutatum*, photographed on the liverwort from within which it was taken in Talbot County, Maryland. Photograph by Paul Bystrak.

Additional localities with similar habitat were visited in Queen Anne's County (12 March) and Somerset County (17 March) where this species has not been recorded, but no other specimens were seen.

Thanks are due Paul Bystrak for providing the photograph, and for accompanying me on the collecting trips.

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NOTES ON *Lampropeltis calligaster rhombomaculata* AND *Rana virgatipes*

Cooper (1961), indicates that a specimen of *Lampropeltis calligaster rhombomaculata* taken from Charles County, Maryland on 1 November 1960 probably represents the latest recorded active date for this species from Maryland. At 1:00 p.m. on 10 November 1973 an adult male *L. c. rhombomaculata* was found DOR by William V. Horvath on Rt. 32 near its junction with the B & O Railroad, Jessup, Anne Arundel County, Maryland. The specimen with a snout-vent and total length respectively of 842 and 982 mm was freshly killed. It is interesting to note that at the time it was found the approximate air temperature was 39° F and that temperatures during all of the preceeding week were below normal for this time of year. The specimen was dissected and found to contain large fat deposits, an indication that it was well prepared for winter. This specimen is now catalogued R 1803 NHSM in the collection of the Natural History Society of Maryland. Another specimen was taken by Robert Ludwig on 17 November 1973 as it was crossing Muirkirk Road near the junction of Md. Rt. 197 and the Baltimore-Washington Parkway, 3 mi. S of Laurel, Prince Georges County, Maryland. This specimen, a female has snout-vent and total lengths respectively of 642 and 735 mm.

Cooper et al. (1973) recently remarked on the paucity of records for *Rana virgatipes* from Maryland and on its apparent precarious position as a member of the herpetofauna of the state. Because there are few records of *R. virgatipes* from Maryland and no new records for many years, the following may be of interest.

It was recently brought to my attention by Paul Bystrak that he and his brother Danny heard choruses of *R. virgatipes* on 18 June 1966 along Powell Creek halfway between Welbourne, Worcester County, Maryland and Greenbackville, Accomack County, Virginia. Specimens were heard calling in both Maryland and Virginia but no attempts were made to collect them

as the Bystraks were running a breeding bird survey and were on a timed schedule. They have never returned to the area in an attempt to secure specimens, however, I feel that this locality should be reported as a possible habitat for this elusive species and efforts should be made to find it there. Other localities that may provide suitable habitat for *R. virgatipes* within Maryland are the cypress swamp SW of Pocomoke City, Worcester County and the cedar swamps W of Federalsberg in Dorchester and Caroline Counties.

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News & Notes

Editorial Comment

Man's populations continue to burgeon and, with this, his demands on the Earth's physical and biological resources are becoming ever more voracious. Forests are being felled, deserts irrigated, and ponds, swamps, and marshes filled and drained to satisfy our need for suitable land areas. Associated with our occupation and use of the land we pollute and poison adjacent areas in ever widening circles. All of these activities, our physical alterations and occupation of space, are reducing land and habitat areas previously occupied by a diversity of animal and plant species. This competion for space, coupled in many cases with our direct exploitation of species' populations for food, clothing, or other purposes, is resulting in a general decrease in the populations of many, if not most, animal and plant species over the surface of the earth.

Many species are already reduced to levels where their continuance is in jeopardy and, without doubt, many more will soon reach these levels. A loss of an animal species is an irrevocable event and a sad commentary on our own wisdom and foresight. What valuable ecological component has been lost? What wealth of undeciphered knowledge did that species represent which we will never know?

This is an issue of major concern with agencies at the international and federal level and, more recently, at the level of the individual states. Lists of species considered to be in serious trouble, "Endangered Species", are now being prepared and plans are underway in many cases to remedy or avert the problems which affect many of these species.

This problem deserves broad publicity and support. We need a view of the problem in general and of the specific problem(s) affecting each of the official and potential "Endangered Species" and what can be or is being done to alleviate these problems.

ENDANGERED SPECIES ACT OF 1973

The Endangered Species Act of 1973 was recently passed by Congress and signed by President Nixon on December 28, 1973. This is a sweeping revision of the old 1969 Act and contains many new provisions. The full ramifications of this legislation will not be understood for quite awhile apparently; it will take considerable effort to develop a working set of regulations and to determine exactly how some of the definitions may be interpreted biologically.

A brief overview of this significant piece of legislation indicates points of special interest: (1) it implements the 1973 Convention on Trade in Endangered Flora and Fauna and will thus have considerable impact on commercial exploitation of herps, (2) it provides for Federal protection of U.S. endangered species if the individual States do not develop acceptable endangered species programs within 15 months--the 1969 Act did not provide for Federal protection except through habitat purchase, (3) it makes Land and Water conservation Funds available again for purchase of these habitats, (4) it provides for a Federal Aid program to support State endangered species projects, (5) it establishes two official categories, endangered and threatened with endangerment, instead of the one endangered category of the 1969 Act (previous "threatened" and "rare" categories of times past were just informal), (6) it expands the government's concern beyond "species" and "subspecies", taxonomically recognized to "populations", thus raising the specter of a real biological nightmare but allowing for the protection of biogeographically significant isolated, etc., populations which have never been blessed with a formal name in the capricious application of taxonomic rigor, (7) it provides for a reasonable "management" approach to threatened species, instead of the rigorous protectionist approach required for truely endangered species; that is, a threatened species might still have special regulations written for it which will allow for reasonable "harvest" by scientists or, in the case of game species, hunters, while still protecting it from commercial exploitation. This allows for a more flexible approach to the whole issue of "endangered species" and points 5 and 6, in tandem, may well be the salient features of this 1973 Act from the herpetologist's viewpoint.

This Act has many other points of interest, too many to go into in detail here, and anyone wishing more information may request a copy from the Director, Bureau of Sport Fisheries and Wildlife, U.S. Department of the Interior, Washington, D.C. 20240.

Received January 1974

REVISED REGULATIONS FOR IMPORT OF INJURIOUS WILDLIFE (LACEY ACT)

A revision of the regulations covering the importation of injurious wildlife was published in the Federal Register on December 20, 1973 (Volume 38, Number 244, Part IV) by the Department of the Interior. The purpose of this revision is to create a "clean list" of animals which are considered low-risk, to replace the previous system of maintaining a "black list" of species known to be hazards to the U.S. ecology, economy, or public health. Obviously, the goal here is to <u>prevent</u> new introductions. The previously used system essentially prohibited the import of a species <u>after</u> it had become an established problem in the U.S.

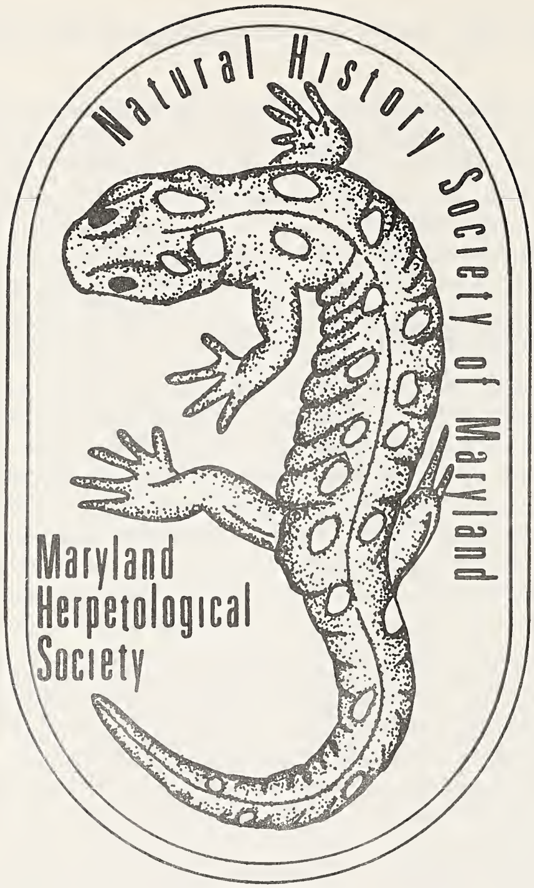
This proposed regulation has received much bad publicity generated primarily from vested commercial interests who fear for their profits from animal importation. The impact of pressure from the aquarium industry can be clearly seen in just a casual review of the proposed list of "clean" species. In contrast to the long list of supposed "clean" fish, no reptiles and only two amphibians are considered "clean". Can we really, on reasonable biological data, argue that the herp list should be extended? The Department of the Interior would like to hear from you on this if you have any arguments.

The issue that has probably been most misrepresented by the opponents of this proposal is the impact it will have on legitimate scientific, educational, and zoological programs. The rumors being circulated suggest that these programs would be hamstrung by this proposal. There can be no argument that this proposal, if passed, will introduce a new and perhaps somewhat inconvenient paperwork hurdle to legitimate scientists who desire to import live specimens for research or display. The disadvantages of this added paperwork, however, should be considered against the positive gains in the prevention of potentially disastrous species introductions.

This proposal is not directed at regulating research on foreign species, but only in assuring that these species, if imported, will not escape. Thus the primary grounds for issuing import permits will be the adequacy of the holding and transport facilities and the responsibility of the worker. The information requested in permit applications is essentially aimed at establishing these points. The quality, pertinence, etc., of the research program itself will only be evaluated for applications to import species which are of outstanding concern, such as endangered species. In those cases the permit applications will be reviewed by an independent, professional, review panel, as they are now.

If you or your associates want to go in the official record with comments, pro or con, on this proposal, please direct your comments (preferably in triplicate) to the Director (FSF/LE), Bureau of Sport Fisheries and Wildlife, Washington, D.C. 20240.

Received January 1974



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Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016. Price is $3.00.

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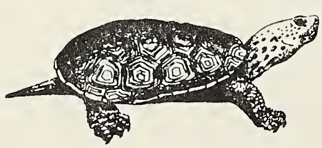
Maryland Herpetological Society

DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.



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EASTERN SEABOARD HERPETOLOGICAL LEAGUE

JUNE 1974 VOLUME 10, NUMBER 2

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Volume 10 Number 2 June 1974

CONTENTS

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ERRATA: Acknowledgement was unintentionally omitted to Dr. Robert S. Simmons for the fine turtle photographs he provided for the article "Turtles at the brink: our endangered species" in the last issue of the Bulletin of the Maryland Herpetological Society (Vol.10, No. 1). The editor was soley responsible for this error.
HSH.

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 10 30 JUNE 1974 NUMBER 2

THE ARGENTINE LAND TORTOISE, *GEOCHELONE CHILENSIS*, AN ENDANGERED SPECIES

Marcos A. Freiberg

(Photos by Rogelio Gutiérrez)

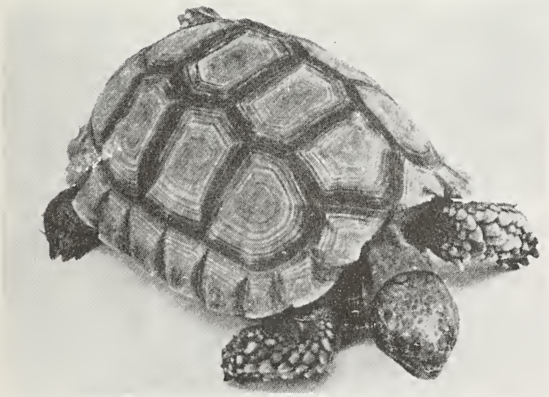

Fig. 1. *Geochelone chilensis* (Gray), from Cordoba, Argentina. (Carapace length 32 cent.)

An important factor sometimes endangering the survival of a species is man's preference for keeping it as a pet, hence, its charm in captivity challenges its existence.

This is exactly what is happening to the Argentine land tortoise, *Geochelone chilensis* (Figure 1), found also in Paraguay. This tortoise has scutes concentrically engraved and decorated with black stripes around the edges. This feature is more prominent in younger specimens (Figure 2) and has made them the object of active trade, which has resulted in great damage to this species in the last few years.

Their appearance and habits are similar to those of the tortoises belonging to the genus *Gopherus*. This is an example of convergent evolution as they both live in similar habitats. They are found in the semi-dry provinces of Argentina and are especially common in Córdoba and Santiago del Estero, in the center and north of the country. Other tortoises found in Argentina are shown in Figures 3, 4 and 5.

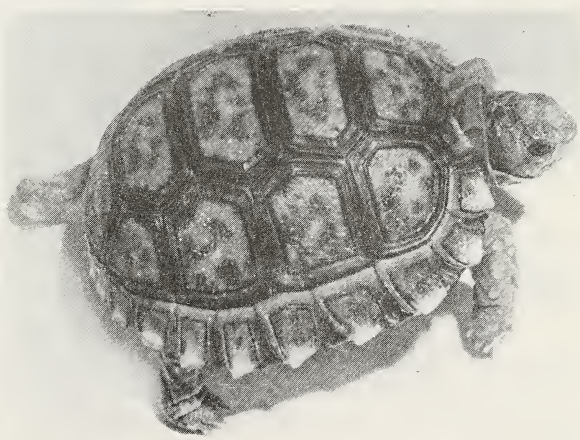

Fig. 2. *Geochelone chilensis* (Gray), young, from Córdoba, Argentina (Carapace length 6 cent.)

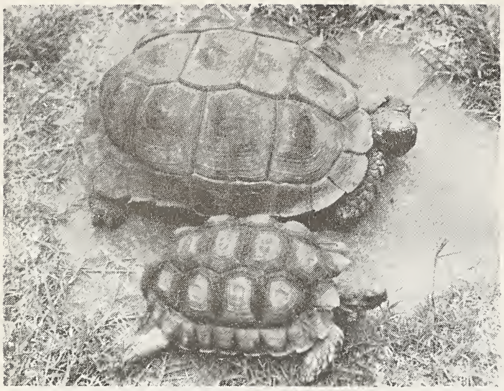

Fig. 3. *Geochelone chilensis* (Gray), (foreground), and *Geochelone donosobarrosi* Freiberg, (rear)

Although, as wildlife, *Geochelone chilensis* is protected by Law No. 13,908 and its regulating decree No.15,501/53, it is subjected to an openly active trade, being freely exhibited in pet shops in the city of Buenos Aires. This violation of the law is not stopped by the pertinent agency the Dirección de Caza y Conservación de la Fauna which depends on the Dirección de Recursos Naturales, thus proving wholly inoperative in this respect.

The adult female may reach 36 cm in length and the somewhat smaller male is narrower with parallel lateral edges and a slightly concave plastron.

Geochelone chilensis is predominantly vegetarian. It enjoys eating the cactus plants abounding in its habitat, swallowing them, without any apparent discomfort from the thorns. It also feeds on leaves, grass and fruit, and in captivity it will readily take pieces of meat.

Fig. 4. *Geochelone donosobarrosi* Freiberg, from Patagonia, Argentina. (Carapace length 43 cent.)

Not much is known about this attractive tortoise. Data show that in November and December the male becomes agressive toward his rivals and woos the female by pushing her gently until they mate. A month later the female digs a hole with her hind feet and in it lays up to six round white eggs (ca. 4.5 cm in diameter) which she then covers with earth.

When conditions are favorable incubation may take as little as four months, but otherwise may take a year. When the young do hatch, they may have to wait for the rain to soften the earth so that they can escape their subterranean entrapment.

Young specimens seen in the pet trade were probably originally collected in the province of Córdoba and Santiago del Estero and then sent by the thousands to Buenos Aires. During transportation, they are packed in bags with no precautions taken to assure their comfort or health and a large proportion does die, unable to survive such rough treatment.

The sale of the survivors is still profitable for these animal peddlers who do not restrict their trade to these reptiles alone, but are devoted to a large traffic in numerous wild species whose sale is equally forbidden.

In the interior of the country the adult specimens, not sent to the capital, are eaten by the local inhabitants who roast them alive claiming that they have a better taste when cooked in this fashion. The shell is used for a variety of purposes

The practices described here are endangering the survival of this species and it will surely disappear if urgent measures are not taken immediately. These measures would require only the enforcement of existing laws. If this is not done, an attractive and harmless species, characteristic of the southern hemisphere, which has been respected by the passing of eons, will disappear, thanks to the action of man who, in his folly, wipes it from existence.

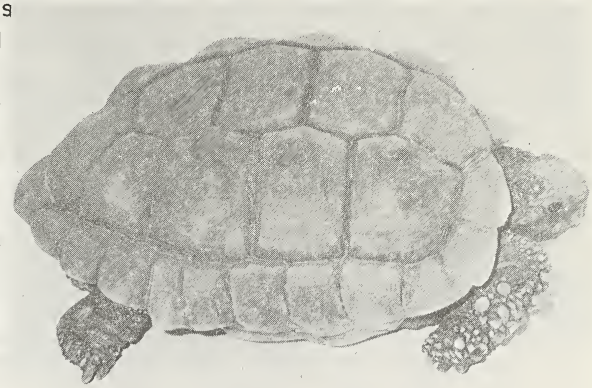

Fig. 5. *Geochelone petersi* Freiberg, from La Banda, Santiago del Estero, Argentina. (Carapace length 18 cent.)

Departamento de Biologie, Universidad de Buenos Aires, Buenos Aires, Argentina.

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THE LEATHERBACK *(DERMOCHELYS CORIACEA)*, ONE OF THE LARGEST LIVING REPTILES

A. J. Zwinenberg

INTRODUCTION

If there is one reptile which people usually find attractive, it is the sea turtle. Its graceful motion and appealing look can be seen to advantage in the large aquaria worldwide. These wonderful creatures evolved from land-dwelling reptiles which laid eggs, and have retained this one vital link with life on land. The females come ashore on sandy beaches, dig holes with their flippers, and deposit their round "ping-pong ball" shaped eggs. During incubation many nests are destroyed by predators, including mammals and other reptiles (Loveridge, 1946). Hatchling turtles are usually attacked by gulls, frigate birds and other animals before they can reach the sea. The few that succeed in reaching the ocean are generally attacked and usually eaten by fish or sharks (Schulz, 1968). Only one in a thousand entering the sea will survive to maturity! Unfortunately, sea turtles are very useful to man. They have been hunted by coastal peoples for many thousands of years for flesh and shell. Turtle eggs are taken for food and offered for sale on local markets. The shell is used for "tortoiseshell", the calipee for soup and the oil for cosmetics. Young turtles are stuffed for sale as souvenirs to tourists (Zwinenberg, 1972). Most species of sea turtles are threatened with extinction in large areas of their range. One of the rarest of these turtles, is the leatherback or leathery turtle.

CLASSIFICATION AND SUBSPECIATION

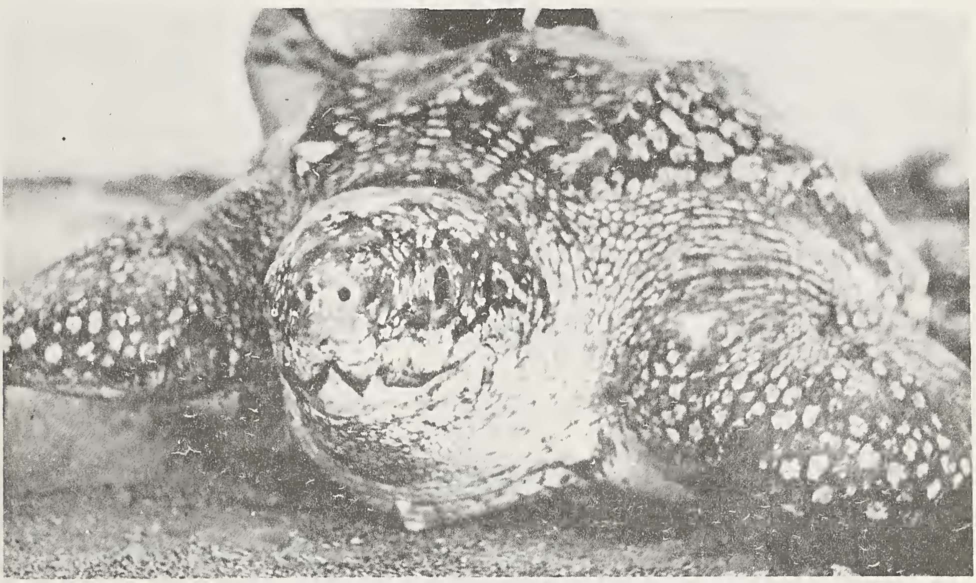
There are six species of sea turtles; five belonging to the family Cheloniidae and one, the leatherback, to the family Dermochelidae. These two families form the superfamily Cheloniodea, which in turn belongs to the sub-order Cryptodira.

The leatherback, *Dermochelys coriacea* (Linnaeus, 1766) is the largest of all sea turtles. It is found in tropical and subtropical seas all over the world. Some herpetologists recognize two subspecies (Worrell, 1963), an Indo-Pacific race (*Dermochelys c. schlegelii*) and an Atlantic race (*D. c. coriacea*). Others however, do not consider it necessary to recognize subspecies, because of the absence of adequate samples for valid comparison. The main differences reported between the two races are as follows:

D.c. coriacea is darker and less spotted than *D.c. schlegelii; D.c.schlegelii* has a somewhat greater skull length than does *D.c. coriacea*. I agree with Pritchard (1971), who proposed to call all leatherbacks *Dermochelys coriacea* until reliable subspecific character differences are described.

DESCRIPTION

The leatherback lacks the horny carapace scutes found in other sea turtles. The streamlined shell is covered instead with a thick, leathery, oily skin that unites a mosaic of hundreds of small separate bones. There are seven prominent longitudinal ridges on the carapace and five on the plastron. The foreflippers are very large and paddle-like, while the hind-flippers, which are mostly employed as balancers and for steering, are much shorter. The limbs have lost their claws completely. The head is large. The upper jaw margin bears two tooth-like projections flanked by deep cusps (Fig. 1). The surfaces of the upper and lower jaw are simple cutting edges, and are devoid of the crushing or chewing plates known in other sea turtles. The nostrils are situated on the tip of the snout so that they can be raised above the surface for breathing. They are closed by fleshy valves as the reptile submerges. Males are recognizable from females, by the tail, which is much longer.



COLOR

The upper surfaces are usually dark brown or black with numerous white or bluish spots. The spots on the head are usually larger than those on the shell. The throat, plastron and ventral surfaces of the limbs are pinkish-white in color, with variable amounts of black vermiculation. Hatchlings are covered with small lizard-like scales. They are blue-black dorsally with white longitudinal stripes and spots which are pale bluish at their margins.

SIZE AND WEIGHT

The leatherback is the largest sea turtle and one of the largest living reptiles. Pritchard (1971) obtained detailed measurements of 192 mature female leatherbacks from French Guiana. The smallest specimen had a carapace length of 54 inches (137 cm), while the largest measured 71 inches (180 cm). The carapace length of about one hundred specimens varied from 61 to 64 inches (154.9 - 162.6 cm). Deraniyagala (1953) gives the demensions of four Ceylon (currently known as Sri Lanka) leatherbacks as follows:

Adult Turtles	lgth. (cm) carapace	lgth. (cm) plastron	weight (kg)
♀	165	115	448
♀	147.5	109	301
♂	155	107	
♂	156	124	

The total length of adult leatherbacks may vary from about 180 to 250 cm. A dead specimen (male) washed ashore at Ameland in the Netherlands in 1968. Its total length was 244 cm and its weight 485 kg. Records of weights of adult leatherbacks vary enormously. According to Pritchard (1971) the reliable records are within 295 to 590 kg (650 to 1300 lbs). Newspaper accounts of leatherbacks caught on the Atlantic coast of the United States of America mention weights of 657 and even 726 kg. Even heavier specimens are reported on the Pacific coast. These records are not reliable; it is likely that the weights are estimated and not actually measured. A large leatherback caught near Laaiplek (western South Africa) was measured by an american herpetologist and found to weigh 644 kg (Pritchard, 1971).

FOOD

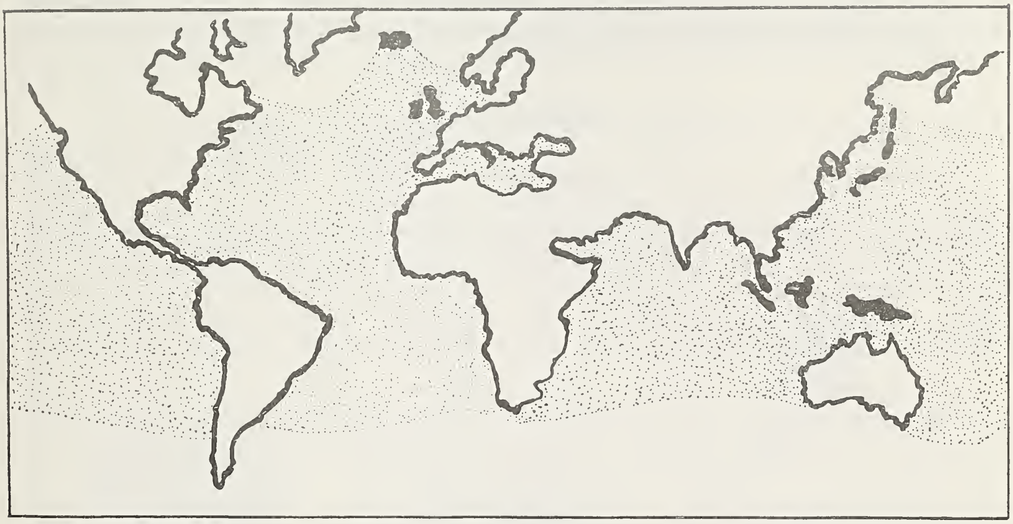
The stomach contents of leatherbacks indicate that they feed on soft bodied, slow-moving animals (Burton, 1970). The diet consists mainly of jellyfish (Scyphomedusidae) and sea squirts (Tunicates) (Rose, 1950, Pritchard, 1971). Blue-green algae and sea-grass have also been reported as well as amphipods and small fishes (Worrell, 1963), but it is most likely that these were ingested accidentally when the turtles were feeding on something else. There is one record of a leatherback stomach containing the remains of large numbers of hatchling ridleys, another sea turtle species.

DISTRIBUTION

The leathery turtle is found in all tropical seas and may wander into temperate waters as well. Individuals are caught at sea in cold, northern waters more frequently than any other species of sea turtle. Specimens have been recorded from the coastal waters of New England and Canada (25x from Nova Scotia - Bleakney, 1965). Leatherbacks are known from

European shores as well. They have been seen as far north as Norway and Iceland (Burton, 1970).

The leatherback is also a visitor to the Mediterranean (Mertens and Wermuth, 1960). Records include Tunisia, Algeria, Morocco and Yugoslavia. Numerous records exist from Japanese waters, especially from the Japan Sea coast of Honshu. The southern border of *Dermochelys's* range runs along the west coast of northern New Zealand, the south coast of Australia, Cape of Good Hope to the mouth of the Rio de la Plata on the Atlantic coast of Uruguay. In the south-east Pacific, leatherbacks are known from Chile as far south as Chiloe Island.



BREEDING BEACHES

The leatherback normally breeds within 20° latitude both north and south of the equator. Females come ashore to lay eggs on specific beaches all over the world, including:

North America (Atlantic coasts): Florida (very rarely).

Central America (Atlantic coasts): beaches of Veracruz and Yucatan, British Honduras, Nicaragua (near San Juan del Norte) and Costa Rica (north of the mouth of the Matina River).

Caribbean and South America (Atlantic coasts): Panama (rarely), Colombia (occasionally), Venezuela (at Punta Playa), Trinidad (good nesting beaches; breeding season between March/April - July/August), Tobago, Guyana (on Shell Beach), Surinam (Bigisanti and Eilanti) and French Guiana (near Cayenne and the mouth of the Organabo River).

West Africa: very little nesting takes place on the coasts of West Africa. There are only a few records for this area. Females are known to have come ashore occasionally in Liberia and the Ivory Coast.

Indian Ocean: two good nesting beaches exist in this area. The first is on the Tongaland coast of Natal (East Africa), the second on Ceylon (Sri Lanka).

Southeast Asia: there is an important leatherback nesting beach in Malaysia. In 1961 a hatchery was founded to insure hatching success. During the first few years the hatching success was approximately 35 percent, but in 1967 no less than 68 per cent of a total of 20,000 eggs hatched. Other nesting grounds exist on the coast of New Guinea and Thailand.

Central and South America: Mexico (on about 10 different places along the Pacific coast) and Peru (though not proven). Nesting probably occurs sporadically along the entire Pacific coast of Central America.

REPRODUCTION

Females crawl up on the sandy beach, usually, late at night (around 11.p.m.), in small groups, about two to four times a season. In Ceylon, fishermen have noted a specimen with only three flippers, which came ashore to lay eggs about once every three months (Deraniyagala, 1953). Pritchard (1971) reports that the largest French Guiana specimens he saw, 70 and 71 inches in length, were so heavy that they could hardly move on land. The animal's breathing was distinctly audible from a distance of several yards.

A female starts digging a nest hole after reaching dry sand. A hollow is excavated with all four flippers and sideway movements of the shell until the turtle is largely hidden. Then sand is thrown back with the powerful front flippers, but after some minutes the female turns around and uses her clawless hind flippers for digging an egg pit. About 50 to 150 soft shelled eggs (2-2½ inches in diameter) are laid at a time. Some nests, contain some undersized, yolkless or otherwise malformed eggs.

The eggs are mostly white, like those of other sea turtles, but sometimes they are flecked with green. When the clutch is completed the reptile sweeps sand into the nest cavity with her hind flippers. When the cavity is full and the nest spot completely hidden, the exhausted animal makes her way back to the sea leaving a track on the beach of about 4 to 6 feet wide. The nests hatch after 60-68 days in Surinam (Pritchard, 1969), 58-72 days (average 67 days) in Ceylon, 56-72 days in Tongaland and 53-60 days in Malaysia.

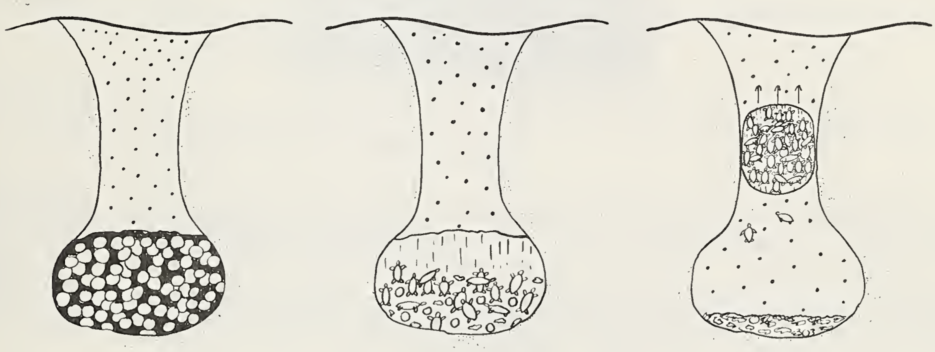
EMERGENCE FROM THE NEST

Herpetologists have always been curious to learn how the hatchlings penetrate through the two to four feet of sand after hatching. Dr. A. Carr, one of the foremost American authorities on sea turtles, kept several clutches of eggs in a glassfronted box with sand, and was able to record this for the first time. Hughes (1969) describes Carr's records on hatching as follows (abbreviated):

"After the turtles have cut their way through the now brittle egg-shell by means of the egg-tooth situated on the upper half of the beak, they

straighten out from the curled embryological position. With hatching there is a decrease in total volume of space occupied by the eggs alone, and this provides an airchamber, which presumably supplies sufficient oxygen for the requirements of the hatchlings once they become really active. After the bulk of hatchlings have hatched the activity starts with threshing the flippers. The young at the top of the nest attempt to scramble up the side of the airchamber and this brings sand down from the sides and roof of the chamber. This sand is now filtered through the entire group of scrambling hatchlings until it reaches the floor of the nest chamber where it starts to form a new floor. Slowly the main body of hatchlings starts to rise towards the surface of the beach as the floor of the chamber becomes thicker and thicker, burying the unhatched eggs, the egg-shells and the unfortunate hatchlings that either possess some gross infirmity or were slow to hatch. They die, because they are unable to make their own way to the surface."

The young generally emerge at night and make for the sea as fast as they can move (Schulz, 1968).



ENEMIES

Eggs are sometimes lost to ghost crabs (*Ocypode sp.*) but they often are dug up by monitor lizards (in Ceylon and Tongaland) and dogs. Hatchlings are killed by the thousands by ghost crabs (in Surinam and Tongaland), genet cats, mongooses (Tongaland), vultures - *Coragyps atratus* and *Cathartes aura* (Surinam (Schulz, 1968) and the Guianas), frigate birds, gulls, feral dogs and other predators. The few young that reach the sea are usually attacked by large fishes (rock cods), octopi and sharks. Even adults are not safe in the water. They often carry scars of bites from past encounters with sharks, and sometimes one or even two flippers are lost in the struggle for life. The uncontrolled collecting of the eggs by man, however, causes the greatest damage (Janssen, 1972, Petzoldt, 1972). Fortunately, the flesh of adults is regarded as inedible. Pritchard (1971) estimates that there are between 29,000 and 40,000 breeding female leatherbacks in the world. An estimate of the number of males is unavailable; since, the males never come ashore, they cannot be counted.

CONCLUSION

We do not know much about the habits and wanderings of this remarkable reptile. It spends most of its time in open sea and is one of the swiftest of testudinates. It is also one of the rarest of all sea turtles - a total of less than 40,000 breeding females for a world-ranging species is not great - and it will soon be threatened with extinction in large areas of its range if not given FULL PROTECTION!!!

ACKNOWLEDGEMENTS

I would like to thank Dr. P.C.H.Pritchard, the well-known marine turtle specialist of the University of Florida, for sending me valuable information on the leatherback, and Mr. P. A. Teunissen at Paramaribo (Surinam) for allowing me to use photographs of the Dienst's Landsbosbeheer and for his help in general.

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Borneostraat 23, Vlaardingen, The Netherlands

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Effects of Photoperiod on Diel Rhythm and Rate of Oxygen Consumption in Juvenile Blue Granite Lizards, *Sceloporus cyanogenys*

The rate of oxygen consumption, $\dot{V}O_2$, in animals is modified by many factors including body size, sex, reproductive stage, nutrition, activity, temperature and photoperiod. Organisms in their natural environments also show rhythms of activity which are reflected in metabolic rate changes, thus changes in $\dot{V}O_2$. Exogenous rhythms occur as a response to environmental change and do not continue in constant conditions. However, rhythms which persist when an environmental condition is held constant, when it is known that the condition can, when fluctuating, affect or determine the form of the rhythm are called endogenous rhythms (Harker, 1958).

This study was conducted to determine a mean rate of oxygen consumption and if the diel rate or rhythm of $\dot{V}O_2$ in these lizards was influenced by photoperiod.

Nine juvenile blue granite lizards, *Sceloporus cyanogenys* were acclimated to 25°C ± 1°C and LD 16:8 photoperiod in a Sherer environmental chamber. The animals were born and maintained under these conditions and were 7 - 10 days old when used in the study. $\dot{V}O_2$ was monitored with Warburg constant-volume respirometers containing NaOH in the sidearm, at 25°C ± 0.5°C. Readings were made in low intensity red light and taken at 30 minute intervals continuously for 24 hours. In an additional study nine juvenile lizards from a second brood were used. These animals were born in constant light, 25°C ± 1°C and were maintained under these conditions for four days prior to being monitored over 24 hours. Prior to use all animals were weighed to the nearest 0.01 g and had a mean weight of 0.82 g.

The mean $\dot{V}O_2$ of the animals under the LD 16:8 photoperiod was 97.1 $\mu l\ g^{-1}\ hr^{-1}$ while animals under constant light had a mean of 124.4 $\mu l\ g^{-1}\ hr^{-1}$ with the difference significant at the .001 level (student's "t") (Fig. 1). Higher metabolic rates under longer photophases would be expected in a diurnal animal. However, not only is the $\dot{V}O_2$ higher but the complete cycle is elevated.

Little work has been published on $\dot{V}O_2$ in juvenile lizards. Bartholomew and Tucker (1964) concluded that the relation of weight to metabolism at a body temperature of 30°C could best be described by the formula $O_2 g^{-1} hr^{-1} = 0.82\ W^{-0.38}$ where W is body weight in grams. Mueller (1969) reported the $\dot{V}O_2$ of a 1.0 g lizard, *S. graciosus* at 30°C as 240 $\mu l g^{-1} hr^{-1}$ which would be approximately 30% of the value predicted from the formula. Another species with a small body weight, *Lygosoma laterale*, had a $\dot{V}O_2$ of 310 $\mu l\ g^{-1}\ hr^{-1}$ or approximately 40% of the predicted value (Hudson and Bertram, 1966). The values obtained in this study are considerably lower than the predicted value but probably represent a better approximation of a mean value. In

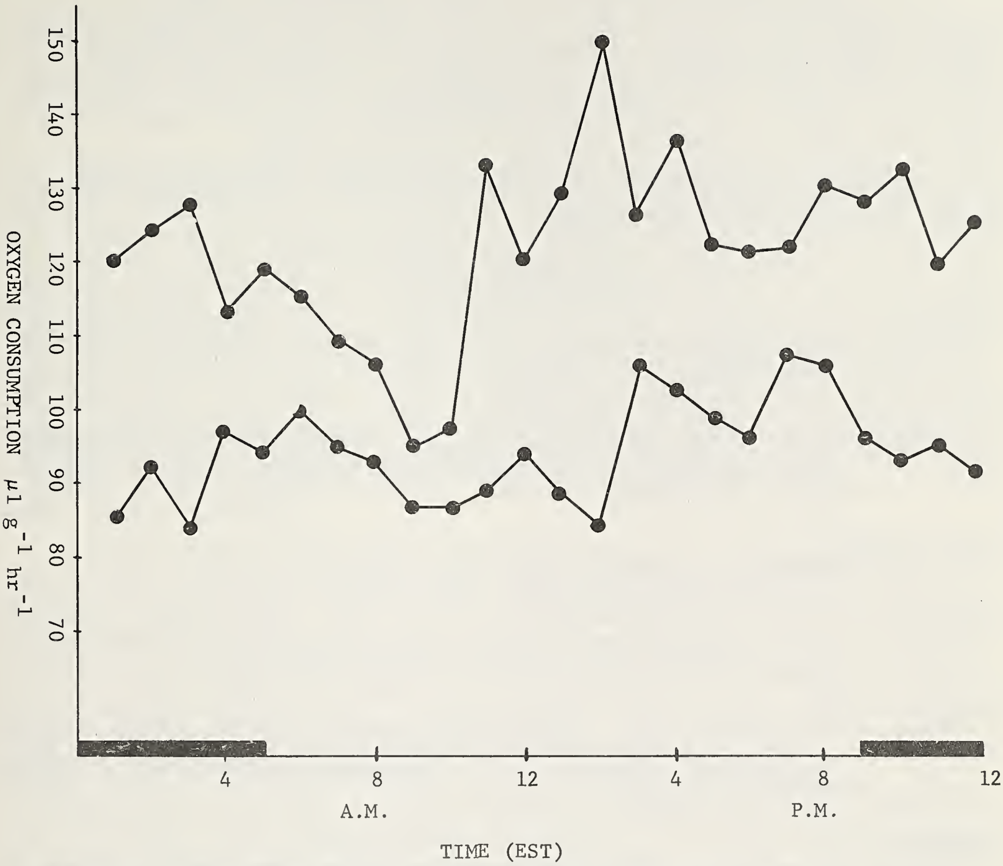

Fig. 1. Diel $\dot{V}O_2$ of juvenile *Sceloporus cyanogenys*. Upper curve, animals run under constant light. Lower curve, animals run under LD 16:8 photoperiod.

an earlier study (Songdahl, 1971) of $\dot{V}O_2$ of juvenile *S. cyanogenys* I obtained a value of 177 $\mu l\ g^{-1}hr^{-1}$ at 25°C which would closely approximate those of Mueller (1969) if the temperature difference is considered. However, Mueller's study was conducted over several two hour periods with readings taken at 15 minute intervals. Periods of 2 - 5 hours are frequently used in deriving mean $\dot{V}O_2$ values. I believe these abbreviated determinations are frequently unrealistic in that the animals undoubtedly reflect the trauma of the situation in increased $\dot{V}O_2$. Furthermore, photoperiod effects and diel variations, which have been shown to be significant (Songdahl and Hutchison, 1972) in $\dot{V}O_2$ studies, cannot be considered when using attenuated tests.

There appeared to be a bimodal rhythm of $\dot{V}O_2$ in the animals acclimated to the LD 16:8 photoperiod. A high level of $\dot{V}O_2$ occurred sometime prior to the onset of the scotophase. A similar rhythm has been shown in adult lizards acclimated to changing light. (Songdahl and Hutchison, 1972).

The animals under constant light did not exhibit a bimodal rhythm. However, a noticable rise in $\dot{V}O_2$ is shown in the early afternoon. Aschoff (1963) found that day-active birds exposed to constant light conditions showed an acceleration in start of activity. These lizards seem to exhibit this trend. Increased metabolic activity commenced approximately two hours prior to those acclimated to changing light.

This work was completed while the author held a traineeship provided by NIH training Grant T01-S00104.

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THE SYSTEMATIC STATUS OF *Trimorphodon lyrophanes* COPE ON CERRALVO ISLAND, GULF OF CALIFORNIA, MEXICO

Banks and Farmer (1963) first reported *Trimorphodon lyrophanes* from Cerralvo Island, Gulf of California, Mexico. This was the first record for the genus on any of the islands in the Gulf of California. The first lyre snake, a male (SDNHM 44395), was collected 26 May 1962, approximately one hour after sundown at the edge of dense brush, north of the salt flat near the southwest end of the island. A second juvenile male specimen (CAS 93015) was collected 29 May 1962 from rocks near the adjacent beach. The third specimen, an adult female *Trimorphodon lyrophanes* (R 1835 NHSM), was collected 12 January 1974 by Señor Pancho Avilés about dusk from a steep rocky arroyo located near the northwest end of Cerralvo Island. The food of these venomous rear-fanged snakes consists, in part, of small mammals, as is evidenced by the remains found in the stomach of this adult female specimen.

Having examined the three available specimens of *Trimorphodon lyrophanes* from Cerralvo Island, I find significant differentiation from the penisular populations only in the number of anterior scale rows, 26 as compared to 23, and temporals, 4+4 as compared to 3+4. Klauber (1940), reports that there is an unusually large number of *Trimorphodon* specimens having an even number of scale rows, as compared with most other colubrid snakes, which seldom have an even number. This results from, either a splitting of the mid-dorsal row to convert the normal 23 to 24 or the suppression of the mid-dorsal to 22. Dorsal, rather than the usual lateral condensations, are evident in *Trimorphodon*. One specimen (CAS 93015) was found to have an increased number of dorsal tail spots, 21 as compared to 10-18 for peninsular specimens. Essentially the dorsal body pattern of Cerralvo Island specimens consists of a series of brown or gray-brown dorsal spots on a grayish to tan background; each spot is divided by a transverse lighter bar much the same as in peninsular specimens.

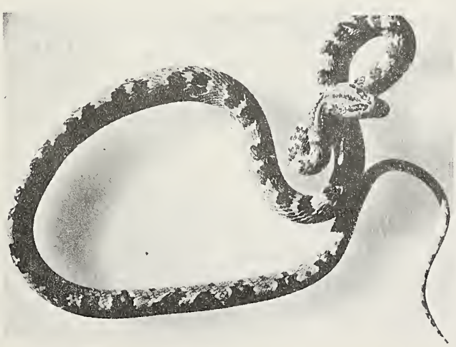

Fig. 1. An adult female *Trimorphodon lyrophanes* from Cerralvo Island (R 1835 NHSM).

Fig. 2. Close-up of the anterior portion of the body of R 1835 NHSM.

Since it will probably be some time before a large series from Cerralvo Island will become available for study, morphometric data for the three currently available specimens are presented and compared with available published morphometric data provided by Klauber (1928, 1940). See Table 1.

TABLE 1. Variation in *Trimorphodon lyrophanes* from Cerralvo Island compared with Baja California peninsular specimens.

	CERRALVO ISLAND			BAJA CALIFORNIA (Klauber 1928, 1940)	
	SDNHM 44395	CAS 93015	NHSM 1835		
Age	Juvenile	Juvenile	Adult	Adult	
Sex	♂	♂	♀	♂	♀
Total length (mm)	283	275	785	-	-
Ventrals	231	229	239	222-235	222-243
Caudals	77	73	67	71-86	63-76
Supralabials	9-8	10-9	9-9	8-10	
Infralabials	10-10	12-11	13-13	10-14	
Temporals	4+4	4+4	3+4	2+3 or 3+4	
Body Spots	27	33	31	21-34	
Tail Spots	17	21	13	10-18	
Scale Rows	26-23-18	26-23-18	26-24-17	23-22-16 (typical)	

Note: All Cerralvo Island specimens counted by author.

When more specimens are available, variation in morphometric data combined with the geographical isolation from the most similar populations on the Baja California peninsula, with the high degree of endemism found in other reptiles occurring on Cerralvo Island, could possibly provide the basis for nomenclatorial recognition of a distinct geographic race.

I am indebted to Señores Ismael and Pancho Avilés, shark fishermen, from El Sargento, Baja California Sur for their valuable assistance in

collecting specimens from Cerralvo Island; to Mr. Herbert S. Harris, Jr. and Dr. Robert S. Simmons, Natural History Society of Maryland (NHSM) for partial financial field assistance and motivation; to Dr. Thomas H. Fritts and Mr. Clark R. Mahrdt, San Diego Natural History Museum (SDNHM) and Dr. Alan E. Leviton, California Academy of Sciences (CAS) for the loan of specimens; to Dr. Benjamin H. Banta, Biology Department, United States International University for guidance; and to Dr. Hobart M. Smith, EPO Biology Department, University of Colorado for editorial suggestions.

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A Pre-Columbian Record of Cannibalism in the Rattlesnake

Powers (1972) has recently commented on a case of cannibalism in the southern Pacific rattlesnake, *Crotalus viridis helleri*, and has reviewed other comparable instances of cannibalism which have been reported in the literature. That this phenomenon has been observed before by American Indians inhabiting what is now Mexico many years before the arrival of Europeans to the New World is documented by figure 18 by Martin del Campo (1936) which is reproduced in figure 1. This figure represents what could

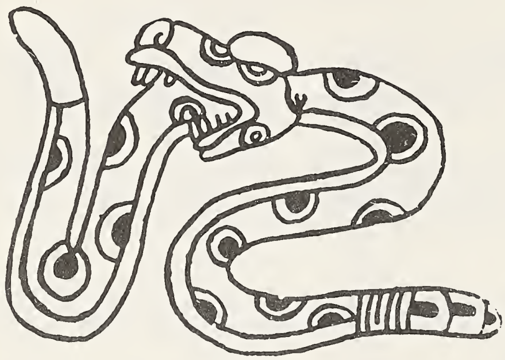

Fig. 1. A pre-Columbian drawing of cannibalism in rattlesnakes (from Martin del Campo (1936): figure 18).

be considered an older snake beginning to ingest a much younger one, judging by the size and number of terminal rattles. This should help allay the concept that only Western Europeans were concerned with detailed descriptions which lead inevitably to the development of Western Science as we now know it.

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Accepted 31 April 1974

First Records of the Eastern Tiger Salamander, *Ambystoma tigrinum tigrinum* Green, in Virginia

Although the eastern tiger salamander, *Ambystoma tigrinum tigrinum*, has been found four miles south of the North Carolina line and less than ten miles north of the Potomac River in Maryland, intensive collecting has heretofore failed to reveal the presence of this salamander in Virginia (Burger, 1961; Tobey, 1973). However two separate discoveries during 1973 finally added the tiger salamander to the official State list of reptiles and amphibians.

On 23 March 1973, we found two freshly laid egg masses of this salamander in Jones Pond, located alongside State Road 54, ten miles west of Ashland, Hanover County, Virginia. Both egg masses were attached to clumps of soft rush, *Juncus effusus*, growing in two feet of water. The margin of Jones Pond is lined by a narrow strip of smooth alder, *Ulnus serrulata*, and *Juncus*. There are a few isolated clumps of *Juncus* growing in deeper water and the egg masses were attached to two of these clumps. We brought the eggs into the laboratory but they failed to develop beyond the tail bud stage. We preserved the egg masses and deposited them in the collection of the Natural History Society of Maryland. David S. Lee, who is working with the tiger salamander in Maryland, verified our identification of the eggs.

On 13 October 1973, an adult tiger salamander was collected by Thomas H. Groff at Tabb, York County, Virginia. Mr. Groff dug up two of these salamanders in his garden but one escaped. The captive specimen is alive at the Peninsula Nature and Science Center (Collection Number PBT 731013-1). Photographs and collection data have been deposited with the Virginia Herpetological Society (Tobey, 1974).

The York and Hanover County localities are approximately 80 airline miles apart; both are within the James-York drainage system. However, York County lies in the Lower Coastal Plain while the Hanover site is located on the Lower Piedmont Plateau, approximately ten miles west of the Fall Line.

Jones Pond is located in an area of hardwood forest with white oak, *Quercus alba*, and tulip poplar, *Liriodendron tulipifera*, as dominants. This pond differs quite markedly from the transient field ponds located in depressions preferred by these salamanders in Maryland (Stine, et. al., 1954). The authors are familiar with Golts and Massey Ponds in Kent County, Maryland, the only active breeding sites of the tiger salamander in Maryland. Neither of these ponds has fish in it. We have been unable to find *A. tigrinum* larvae in Jones Pond. We feel that predation by a large population of fish, such as crappie, bluegill, and bass, in the pond is the most likely reason for the absence of larvae.

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——John B. Funderburg, Charles H. Hotchkiss, and Peter Hertl, *Department of Biology, Randolph-Macon College, Ashland, Virginia 23005.*

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The Wood Frog, *Rana sylvatica* Le Conte, in the Virginia Coastal Plain

The wood frog, *Rana sylvatica*, is a northern species whose southern limit is reached in northern Virginia except in the mountains where it occurs as far south as South Carolina (Wright, 1949; Conant, 1958). In the Delmarva Peninsula it is found as far south as Somerset and Worcester Counties, Maryland (Harris, 1969).

On 18 March 1973, the authors were collecting reptiles and amphibians along Crump Creek, one mile east of the junction of this creek and State Road 651 in Hanover County, Virginia. In a pothole on the floodplain of the creek we found three egg masses of the wood frog attached to sticks which protruded above the surface. The eggs had hatched but we collected the jelly masses and preserved them. They have been deposited in the collection of the Natural History Society of Maryland. Efforts to secure tadpoles from this pothole were not successful nor did we find either eggs of frogs at this site in 1974.

During the afternoon of 6 March 1974, we found two freshly laid wood frog egg masses 1/2 mile north of the junction of US 301 and State Road 601 in Caroline County, Virginia. These egg masses were found in a ditch flowing through a culvert under US 301. We did not disturb the eggs and returned to the site that evening and captured an adult female wood frog floating near the eggs. We also collected a small egg sample. Both the female and eggs are deposited in the collection of the Biology Department at Randolph-Macon College.

These collecting sites are both located on the Upper Coastal Plain near the Fall Line. They are approximately 25 miles apart. Since the wood frog is common in the lower portion of the Eastern Shore of Maryland, it is quite likely that more intensive collecting in the Lower Coastal Plain of Virginia will reveal other disjunct populations of this frog.

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——John B. Funderburg, Charles H. Hotchkiss, and Peter Hertl, *Department of Biology, Randolph-Macon College, Ashland, Virginia 23005.*

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Some Amphibians and Reptiles from Iran

Iran is a mountainous country in southwest Asia whose nearly one and two-thirds million square kilometres represent a land area nearly the size of France, England, Ireland, Italy, and Spain taken together (Firouz, 1971). Arid, interior steppes and extreme deserts occupy large parts of the Central Plateau; mountain peaks reach to almost 5800 metres in the Alborz range, while elevations along the Caspian Sea dip to 26 metres below sea level. Varied habitats and climates throughout the country support approximately 185 described species of amphibians and reptiles, of which five forms (a salamander, a frog, two lizards, and a snake) have been added since my account less than three years ago (Tuck, 1971). S. C. Anderson (pers. comm.; Tuck, 1973) is in the process of publishing descriptions of two new Iranian geckos, and J. Eiselt (pers. comm.) has communicated to me notice of his having discovered another new Iranian gecko.

Photographs presented here depict only a very few members of the rich Iranian herpetofauna. Most examples have been preserved in the Muze-ye Tarikh-e Tabi'i (=National Museum of Natural History) (MMTT), Department of the Environment, Teheran; the tortoise and the seasnake are still alive as of this writing.

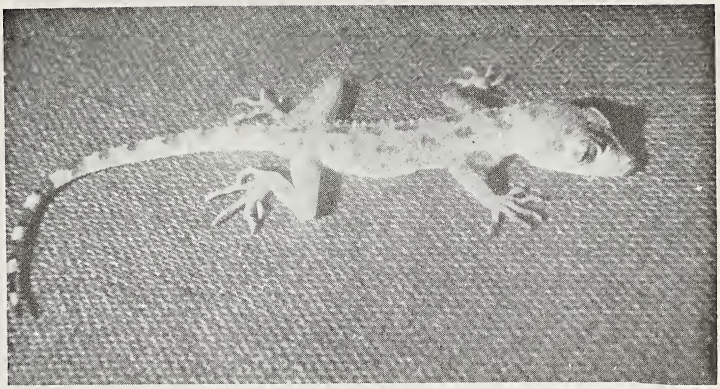
I thank His Excellency, Mr. Eskandar Firouz, Director of the Department of the Environment, for permission to present this material. All specimens were collected by various members of the Department during the course of official research and field work.

Southern Crested Newt,
Triturus cristatus karelinii

This form, which ranges from the eastern Balkans in Europe to the southern end of the Caspian Sea area, is one of the five species known or believed to inhabit the mountains of Iran. This individual, now preserved as MMTT 205, measured 47 mm snout-vent length. It may be a topotype, having been collected in the Dashte-Naz National Park, Mazandaran Province, apparently near the type locality; it was collected 6 November 1973.

Iberian Tortoise,
Testudo gracea ibera

This form, which ranges from south-eastern Europe and adjacent Asian areas into central Iran, is one of the five species of turtles generally listed for the land, fresh and brackish waters of the country. Several sea turtles also visit parts of the southern coast. This living example measures about 205 mm in oarapace length. It was captured about 20 km north of the town of Shahpour, West Azarbaijan Province, on 10 July 1973, and is still thriving in captivity.



Keeled Rock Gecko
Cyrtodactylus scaber

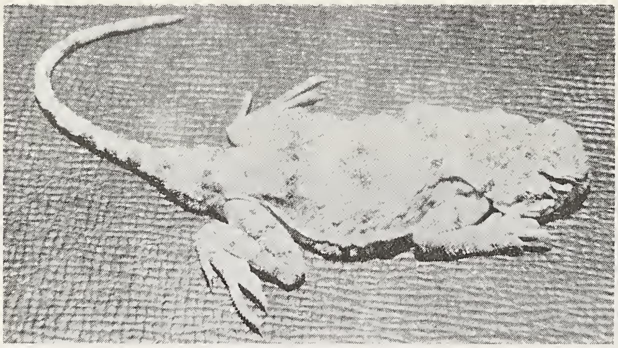
This species extends from Egypt to Rajputana and prefers arid habitats. It is one of the 34 or more species of geckos believed to inhabit Iran. This tiny (36 mm snout-vent length) individual (MMTT 197) is a juvenile taken in one of the Department's offices in the city of Teheran, Central Province, on 10 October 1973.

Brilliant Agama
Agama agilis

This species is believed to range from eastern Iraq and northeastern Arabia to southwestern Afghanistan and western Rajasthan, but the current studies of S. C. Anderson (pers. comm.) may indicate a different concept of the distribution of this form. The Brilliant Agama is but one of seven species generally assigned to the Iranian *Agama* representatives. This individual (MMTT 186) measured 73 mm in snout-vent length; it was collected 25 September 1973 on the road to Na'in, about 60 km east of Esfahan, Esfahan Province. I kept it alive for several weeks and one day inadvertantly placed it with an example of Persian Steppe Lacerta, *Eremias velox persica*; the tragic result is represented by Photograph No. 5.

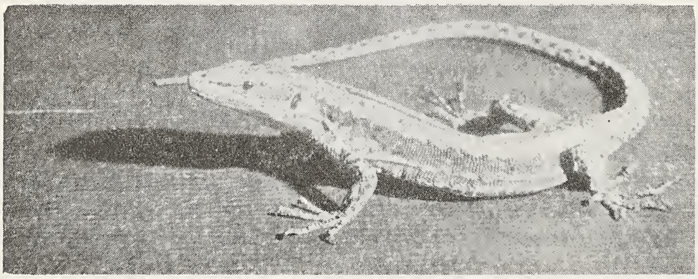
Brilliant Agama eating
Persian Steppe Lacerta

The victim of the Agama's appetite was collected in the Mohammed Reza Shah National Park on 24 September 1973; the Park is in Mazandaran and Khorasan Provinces.



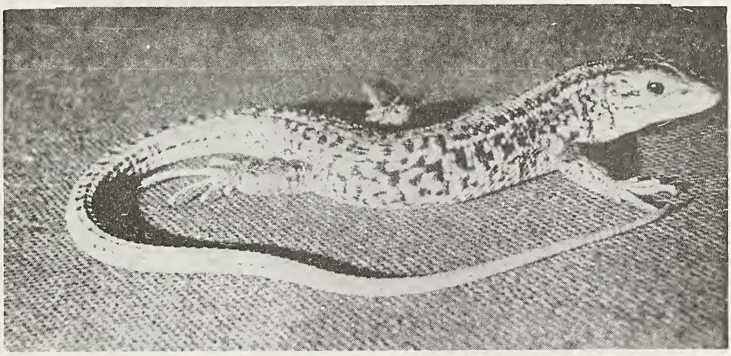
Toad-head Agama
Phrynocephalus helioscopus helioscopus

Superficially similar to the familiar North American Horned Lizards, genus *Phrynosoma*, this species ranges from parts of the Soviet Union into Mongolia, northern Iran, and northeastern Turkey. Seven other species of Toad-head Agamas are considered part of the Iranian Herpetofauna. This example, MMTT 184, measured 48 mm snout-vent length and was collected about 25 km north of the town of Pahlavidezh, Mazandaran Province, on 25 September 1973.



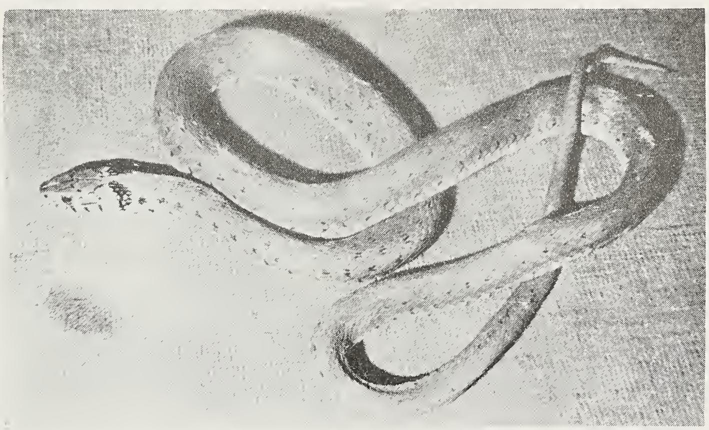
Green-bellied Lacerta
Lacerta chlorogaster

Iran shares this forest-dwelling lizard with adjacent parts of the Soviet Union in the general area of the Caspian Sea. This example, MMTT 182, measured 64 mm snout-vent length, and it was collected in the M hammed Reza Shah National Park, Mazandaran Province, on 24 September 1973. Five other species of the genus *Lacerta* are part of the Iranian herpetofauna.



Snake-eyed Lacerta
Ophisops elegans

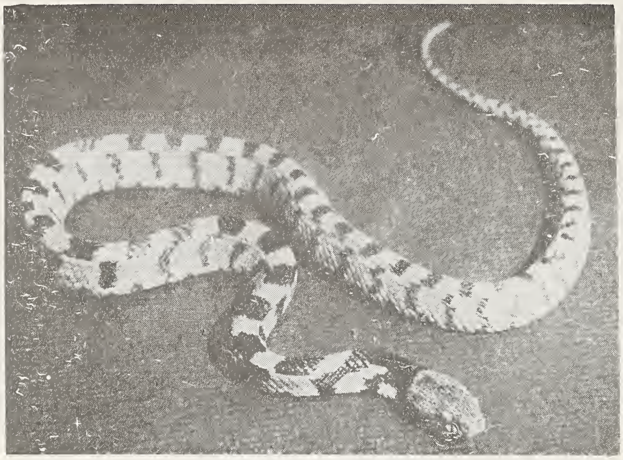
Lack of eyelids characterize members of this small species, which is distributed from Asia Minor to parts of the USSR, Iran, Iraq, and Sinai Peninsula. It is common in stony plains and on rocky hillsides. This specimen, MMTT 198, was taken on Arezou Island, in Lake Rezaiyeh Protected Region, West Azarbaijan Province, 10 October 1973. It measured 52 mm snout-vent length.



Balkan Grass Snake
Natrix natrix persa

This wide-ranging form is distributed from Greece, Bulgaria, Albania, Yugoslavia, Turkey, Cyprus, and Transcaucasia to northern Iran and southwest Turkemenistan. Unlike North American representatives of the genus, this species lays eggs. Furthermore, after displaying typical *Natrix* habits when captured, individuals may feign convulsions and death very convincingly, as did this specimen (MMTT 187) during one of the photographing sessions. This individual was collected in the Miankaleh Protected Region,

Mazandaran Province, on 27 September 1973. It measured 535 mm snout-vent length.



Iberian Cat Snake
Telescopus fallax ibericus

Because it is rear-fanged and small, the Iberian Cat Snake is not considered dangerous. It ranges from the Caucasus area, eastern Turkev, and northern Iraq into northwest Iran. This form prefers small lizards, and this individual (MMTT 183) ate a hatchling Caucasus Agama (*Agama causcasica*) in captivity. This example was collected on Kabudan Island, Lake Rezaiyeh Protected Region, West Azarbaijan Province, 1 September 1973. It measured 248 mm snout-vent length.

Pelagic Seasnake
Pelamis platurus

Although this species, like all seasnakes, is highly venomous, villagers and fishermen contended it was quite harmless when I went to various elaborate means of picking up and handling specimens for which they would

take no precautions. This living individual was taken in addition to a preserved series (MMTT 199 - 204). It was one of the smaller examples collected, measuring about 500 mm snout-vent length, and was found on the beach of Hormoz Island, Strait of Hormoz (between the Persian Gulf and the Sea of Oman), 22 January 1974.

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Robert G. Tuck, Jr., Curator/Advisor, *Muze-ye Melli-ye Tarikh-e Tabi'i, Department of the Environment, P. O. Box 1430, Teheran, Iran.*

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Accepted 2 March 1974

Ed. Note: This paper and slides were presented by proxy at the March 2, 1974, Eastern Seaboard Herpetological League meeting in Baltimore.

NEWS & NOTES

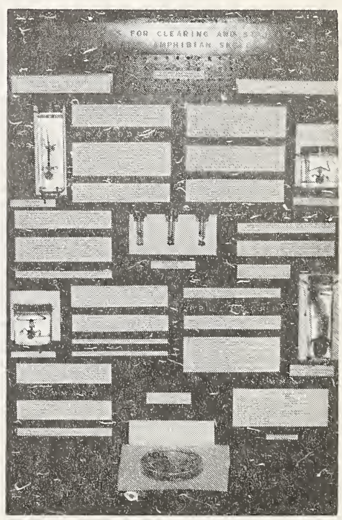
EASTERN SEABOARD HERPETOLOGICAL LEAGUE MEETING

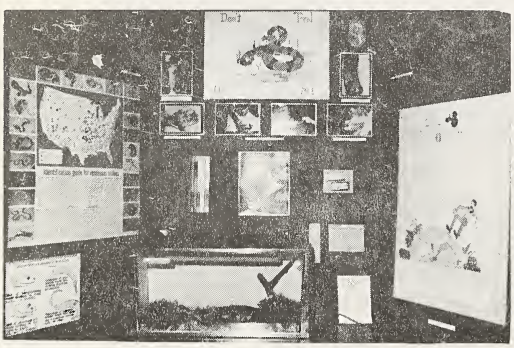
Sponsored by the Maryland Herpetological Society, held 2 March 1974

The March 2nd, 1974 meeting of the Eastern Seaboard Herpetological League (ESHL) was held in Baltimore, at the Essex Community College. This meeting was well attended despite the energy crisis. The MdHS apologizes for only giving slightly over a months notice that the meeting would be held at this college. More time to plan the trip to Baltimore may have helped attendence some. Several of the ESHL constituent groups were not in attendence . . . despite the fact that the city and date were known since last October's ESHL meeting.

The log book, located at the door of the auditorium, contained the names of 91 persons who had signed in. The following participating groups were represented: Connecticut Herpetological Society (CtHS), Massachusetts Herpetological Society (MaHS), Maryland Herpetological Society (MdHS), Philadelphia Herpetological Society (PHS), Virginia Herpetological Society (VaHS), Washington Herpetological Society (WHS). Congratulations are in order to CtHS and MaHS for chartering a bus to attend this meeting in Baltimore, thus saving gasoline.

Displays were arranged by Jeff Thomas (MdHS), Ricky Czarnowsky (MdHS) and Howard Schwartzman (MdHS). Mr. Czarnowsky and Mr. Thomas's exhibit displayed alternate methods of clearing amphibians and reptiles, while Mr. Schwartzman's exhibit concerned poisonous snake bite. Mr. Czarnowsky also worked on this exhibit.





Mr. Robert G. Tuck, Jr. (past President of MdHS and past coordinator of ESHL) presented an illustrated slide presentation "Some amphibians and reptiles from Iran" at the meeting by proxy. His presentation is presented elsewhere in this issue.

Abstracts of the talks presented at the March 2, 1974 ESHL meeting are as follows:

Jerry D. Hardy, Jr. (MdHS) - "Frogs, Islands and Evolution in the Caribbean"

Abstract-
The possible interrelationship of the various species of *Eleutherodactylus* occurring in the southeastern Caribbean were discussed. Primary emphasis was placed on Tabago and Guadeloupe. A northward dispersal pattern was suggested.

David S. Lee (MdHS) - "Maryland's Endangered Species"

Abstract-
Maryland has a diverse flora and fauna. This is because of marked differences in the state's ecosystems and drainage patterns. Various factors affecting these ecosystems and their inhabitants were discussed.

William and Donna Marvel (MdHS) - "Speciation is the Garter Snakes"

Abstract-
Some possible causes of speciation and lines of evolution among U.S. forms of *Thamnophis* were discussed. Slides were shown of most native species and of representative geographical races.

Herbert S. Harris, Jr. & Robert S. Simmons (MdHS) - "Rattlesnakes of the World"

Abstract-
Photographs representing 71 of the 77 currently recognized subspecies (30 of 31 species) and 8 new proposed subspecies were shown. Brief notes on evolution, distribution and phylogeny were discussed.

Mr. Earl Baysinger of the United States Department of the Interior discussed and explained the recent proposed legislation controlling the importation of wildlife . . . Injurious Wildlife (Lacey Act). He also discussed the recently passed Endangered Species Act of 1973. A question and answer period followed the discussions.

The program went into overtime and left little time for the "Meeting of Designated Representatives", as the participants departure times had

been preset. Since this is the purpose for ESHL meetings, future programs should perhaps schedule the meeting of Designated Representatives early in the day. In all, this meeting was a success.

The New York Herpetological Society has volunteered to host the October 1974 Meeting. See you in New York!

Where were you March 2, 1974 . . . NYHS, TMG, ACTT !!!

Careers in Biological Systematics

The Society of Systematic Zoology has just published a sixteen-page, illustrated brochure for persons who are considering a career in animal or plant systematics. The field of systematics is described, together with examples of current research; other sections of the booklet deal with employment, training and recommended readings. Single copies are available free of charge by writing SSZ, c/o Department of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, D. C. 20560, U.S.A.

Important Paper Reprinted

Raymond Cowles and Charles Bogert's "Preliminary Study of the Thermal Requirements of Desert Reptiles" has now been reprinted by the Society for the Study of Amphibians and Reptiles, together with a preface by Harvey Pough that summarizes recent literature on the topic. The paper was originally published as a *Bulletin of the American Museum of Natural History*,

volume 83, pages 261-296, 11 plates, 1944. This pioneering work is still of continuing interest to physiologists, ecologists, behaviorists and herpetologists; single copies cost $1.00 post-paid but instructors who wish to make copies available to students may purchase quantities at reduced prices (20-49 copies, 75¢ each; 50 or more, 50¢ each). Send orders to Dr. Henri C. Seibert, Publications Secretary, SSAR, Department of Zoology, Morton Hall, Ohio University, Athens, Ohio 45701, U.S.A.

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SEA TURTLES AND THE TURTLE INDUSTRY

of the West Indies, Florida, and the Gulf of Mexico.

by Thomas P. Rebel

Publication date: March 22, 1974

Price: $10.00s

Pages: 250

Illustrated: ISBN 0-87024-217-2

SEA TURTLES, summarizes the current knowledge on taxonomy, life history, the fight for survival from man who pursues them endlessly for food and shell and who's ever-increasing civilization is encroaching their remaining nesting beaches, conservation measures to protect them, etc., of our marine turtles. Over 800 published sources were consulted for information on life histories, and the data sorted by species for easy reference. Breeding habits, behavior, physiology, diet, growth, distribution and migration, enemies and taxonomy are discussed. Also covered are fishing methods, cultivation efforts, administration of turtle fisheries in the Caribbean and legislative measures taken to protect them. In general, this book brings together our current knowledge of the marine turtles and presents the data in an easy to understand format that every one can comprehend.

H.S.H.

NATIONAL SWEDISH HERPETOLOGICAL ASSOCIATION

The National Swedish Herpetological Association, NSHA (Sveriges Herpetologiska Riksförening) is a union of five local societies, viz. Malmo Terrarieförening/MTF, Göteborgs Herpetologiska Förening/GHF, Stockholms Herpetologiska Förening/SHF, Linkopings Terrarieförening/LTF and Uppsala Herpetologiska Förening/UHF. The number of members are 55, 55, 70, 25 and 20, respectively.

The association was formed 1971 by four already existing local societies. It publishes a journal, Snoken (the Colubrid), that appears five times per year. The journal, written in Swedish, contains articles on husbandry, observations on ecology and behaviour, reports from travels abroad, reviews of different groups, debates etc.

The deciding body of the association is the congress that meets twice a year. Between the congresses it is represented by an executive committee of three persons.

Activities in the local societies include; lectures, often by members of the other societies, excursions and exhibitions.

Most members are interested in keeping and studying live animals, particularly lizards but also snakes and frogs. There is a growing interest for the study of the local faunas. Many members also make travels abroad, also to other continents, to study herps. In general the members are amateurs, a few are studying biology at universities, among them some do research on herpetological subjects. Two members also have permanent exhibitions for the public, in Kolmården (near Norrköping) and Helsingborg (near Malmö).

The association can be contacted through the address; SHR, c/o Jon Loman, Ekologihuset, Zool. Inst., University of Lund, 22362 LUND, Sweden.

Following, is an appeal we received from the National Swedish Herpetological Association. It is presented here so that interested members may also respond......

Lund 20/2 1974

The National Swedish Herpetological Association is interested to know whether your organization could consider to take part in a joint action against those animals dealers that offer amphibians and reptiles that are threatened with extinction for sale. As it has appeared that a large number of dealers offer such animals we consider some kind of action urgent.

We suggest that each society sends a letter similar to the one below to all dealers known to them. Please inform us if you take part in this action.

On behalf of NSHA, sincerely yours, Jon Loman

SHR, c/o Jon Loman, Ekologihuset, Zool. Inst., University of Lund, 223 62 LUND, Sweden.

(Suggested letters to animal dealers; only the valid part is to be sent or the invalid overlined)

Dear sir:

After reading your stock list, dated ____, we find that you offer the following species of amphibians and reptiles, that according to the Red Data Book (obtainable from IUCN, Morges, Switzerland) are threatened with extinction:

We will inform our members of this and recommend them not to trade from you until you have ceased offering these animals. We will be glad to hear from you when you have done so.

On behalf of ____, sincerely yours

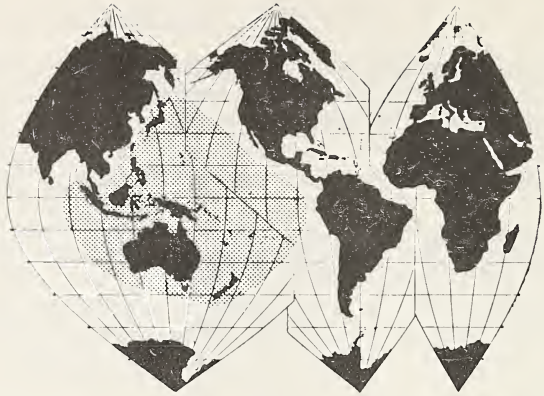
Dear Sir:

After reading your stock list, dated ____, we are glad to find that you are not offering any threatened species for sale. We will inform our members of this fact.

On behalf of ____, sincerely yours

The MdHS has informed the NSHA that we will participate in this endeavor. This action was sanctioned at the Steering Committee and Business Meeting held March 27, 1974 by the officers and members present.

The SSAR Conservation Committee has praised the NSHA for their concern and idea, which the committee feels could be an effective approach to discouraging trade in endangered and threatened species.



::Loveridge
REPTILES (and Amphibians) OF THE PACIFIC

271 pages, 7 plates, 1 double-page map, index (originally published in 1946 by Macmillan Company, New York)

THIS BOOK treats the herpetofauna of a vast region including Indonesia, the Philippines and Japan, Australia, New Guinea and New Zealand, and an enormous array of islands including Hawaii and the Galápagos. With such isolated land masses, the fauna is predictably diverse and includes the tuatara, several crocodiles, various lizards including the Komodo dragon, flying lizards and the Galápagos iguanas, numerous pythons, the king cobra and other poisonous elapids and vipers, the wide-ranging marine turtles and sea snakes, caecilians, the giant salamander, and many frogs and toads.

Authoritative yet written in a clear and untechnical manner, this book is the standard reference on the Pacific herpetofauna and is equally useful to professionals and amateurs. Each species is described and its range noted, together with a discussion of its life history and remarks on capture, captive specimens, reproductive habits, and use as food. There are identification keys to families and species, illustrated with seven diagnostic plates. Finally, there are chapters on snake bite and its treatment, economic aspects and conservation, collecting techniques, procedures for shipping living and preserved specimens, and an annotated bibliography.

Mr. Loveridge, now retired, was formerly curator of herpetology at Harvard University, and is a noted authority on the amphibians and reptiles of Africa and the South Pacific.

prices

SSAR members *before publication:* $10 paperbound, $12 clothbound
Institutions and non-members: $15 paperbound, $17 clothbound

to order

Orders may be placed now. This book will be published in fall 1974; to take advantage of special prices, SSAR members must place their orders before publication. Please circle edition desired and send with payment to Dr. Henri C. Seibert, Morton Hall, Ohio University, Athens, Ohio 45701, U.S.A. Make checks payable to: "SSAR." Receipt sent on request only.

Please mark these boxes if you want information on SSAR membership ☐ or a complete list of Society publications ☐. Publications issued by the Society include the *Journal of Herpetology, Facsimile Reprints in Herpetology, Herpetological Review, Herpetological Circulars, Catalogue of American Amphibians and Reptiles,* and the several series published by SSAR's predecessor, The Ohio Herpetological Society.

Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.05/page.

Information for Authors

All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8½ x 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016. Price is $3.00.

Reprints are available at $.025 a page and should be ordered when manuscripts are submitted or when proofs are returned. Minimum order is 100 reprints. Either edited manuscript or proof will be returned to author for approval or correction. The author will be responsible for all corrections to proof, and must return proof preferably within 7 days.

The Maryland Herpetological Society
Department of Herpetology
Natural History Society of Maryland, Inc.
2643 North Charles Street
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Maryland Herpetological Society

DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

MDHS.......A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

SEPTEMBER 1974 VOLUME 10, NUMBER 3

Bulletin of the Maryland Herpetological Society

Volume 10 Number 3 September 1974

CONTENTS

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Editor's Note: In: First records of the eastern tiger salamander, *Ambystoma tigrinum tigrinum* Green, in Virginia by Funderburg, Hotchkiss & Hertl (1974, *Bull. Md. Herp. Soc. 10*(2):57-58), no mention was made of an earlier published record ....Tirrell, Peter B., 1974. Tiger salamander found in York County, Virginia. *Va. Herp. Soc. Bull. 74*:1. The latter involved one of the records reported by Funderburg, et. al.

The Maryland Herpetological Society, Department of Herpetology, Natural History Society of Maryland, Inc., 2643 North Charles Street, Baltimore Maryland 21218.

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BULLETIN OF THE mdhs

Volume 10 Number 3 30 September 1974

The Maryland Herpetological Society

Department of Herpetology, Natural History Society of Maryland, Inc.

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Membership Rates

Active members over 18....$10.00, under 18....$6.00, subscribing members (outside a 20 mile radius of Baltimore City)....$3.00, Foreign....$4.00.

Meetings

The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May-August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 10 30 SEPTEMBER 1974 NUMBER 3

A PRELIMINARY ECOLOGICAL SURVEY OF THE MATTAPONI - POLECAT CREEK SWAMP IN CAROLINE COUNTY, VIRGINIA

The Mattaponi - Polecat Creek Swamp in east-central Virginia is an interesting ecological area. Our preliminary observations indicate that future studies of this swamp, which is located in a "suture zone" (Remington, 1968) between the northern and southern biotas, may well play a significant role in developing our understanding of the distributional patterns of reptiles and amphibians in the Chesapeak Bay region.

The swamp is located astride US 301, eight miles south of Bowling Green and 32 miles north of Richmond. It is easily accessible to herpetologists traveling through Virginia. I feel that presenting a general ecological description of the area at the present time would help expedite the analysis of data collected by naturalists who study the area since it would give them a familiarity with the relationship of the swamp on US 301 to the overall drainage system.

The Mattaponi River, on the Coastal Plain of Caroline County, is formed by the confluence of the Matta, the Po and the Ni Rivers. The headwaters of these three rivers lie on the rolling, heavily dissected terrain of the Piedmont of Spotsylvania County. These rivers maintain their integrity as they cross the Fall Line, but merge as soon as they flow down onto the Upper Coastal Plain.

Polecat Creek, whose headwaters rise in southwestern Caroline County, flows parallel to the Mattaponi and crosses US 301 a half-mile south of the Mattaponi bridge. Polecat Creek then joins the Mattaponi about one-half-mile east of these bridges. After some thirty miles the Mattaponi joins the Pamunkey River to make up the York River in the Lower Coastal Plain. Thus this drainage system can be considered a transect along the rocky, swift-flowing creeks of the Piedmont, down the slow-moving, muddy rivers of the Coastal Plain to the tidal marshes and brackish waters of lower Chesapeake Bay.

At US 301 the swamp is five miles wide. It is bordered on both sides by white oak (*Querous alba*)—mockernut hickory (*Carya tomentosa*) climax forest. Much of this forest has been cut and replanted to loblolly pine, (*Pinus taeda*). Higher areas in the swamp itself are also dominated by loblolly pine.

Most of the swamp is subject to intermittent flooding but the most productive areas, as far as wildlife is concerned, are those areas that remain flooded because of dams built by beavers. Although the water levels vary somewhat, large areas of the swamp on the west side of the highway are kept under water by beavers which utilize highway fill as a dam. On the western side of the highway there is a pile of debris at every culvert

under the highway. This debris is placed there by the highway department in an effort to keep water flowing through these culverts. However, our observations indicate that as fast as highway personnel clear the culverts the beavers plug them up again. There are numerous beaver dams elsewhere in the swamp also.

The water of the swamp is dark-stained but clear. The staining is is derived from a heavy layer of leaves and decomposing vegetation overlaying the muddy bottom. It is slightly acid with an average pH of 6.4.

In many places, particularly along the river banks, there are thick deposits of coarse-grained sands and pebbles brought down from the Piedmont by periodic floods.

Our initial contact with the swamp was the result of a letter from Mr. Franklin J. Tobey, Secretary of the Virginia Herpetological Society, informing me that Dr. Roger Conant had written him about a tape made of a frog chorus in this swamp in 1967 by Dr. Ann Pace of the University of Michigan. Included in this chorus were calls of the carpenter frog, *Rana virgatipes*, and Tobey asked me to try to secure specimens of this frog. During the fall of 1973, we found these frogs to be rather common in the swamp (Funderburg, et. al., 1974a).

In late February and March, 1974, we collected northern spring peepers, *Hyla c. crucifer*, upland chorus frogs, *Pseudacris triseriata feriarum*, and Brimley's chorus frogs, *Pseudacris brimleyi*, along with carpenter frogs which were also active at that time. On later trips we secured American toads, *Bufo terrestris americanus*, bullfrogs, *Rana catesbiena*, green frogs, *Rana clamitans melanota*, pickerel frogs, *Rana palustris*, northern leopard frogs, *Rana pipiens*, northern cricket frogs, *Acris c. crepitans*, southern cricket frogs, *Aeris g. gryllus*, and three-lined salamanders, *Eurycea l. guttolineata*. The only reptiles secured thus far have been the eastern mud turtle, *Kinosternon s. subrubrum*, the stinkpot, *Sternotherus odoratus*, the eastern painted turtle, *Chrysemys p. picta*, the spotted turtle, *Clemmys guttata*, and the eastern box turtle, *Terrepene c. carolina*. We also found the wood frog, *Rana sylvatica*, one mile south of the swamp but have not found it in the swamp itself although it undoubtedly occurs there (Funderburg, et. al., 1974b.)

In late January and early February, the only aquatic cover for carpenter frogs was a dense growth of *Spirogyra*. Almost every frog we saw was floating in an opening in this thick mat of algae which covered most of the surface. By late April, when the water was much warmer, *Spirogyra* was dying and a dense growth of the submerged stems and leaves of bladderwort, *Utricularia inflata*, and mats of *Bacopa monnieri* offered cover for amphibians.

The overstory of the swamp is composed of sweet gum, *Liquidambar styraciflua*, and willow oak, *Quercus phellos*, with occasional loblolly pines, *Pinus taeda*, and red oaks, *Quercus rubra*, growing on more elevated areas. The understory is made up of red maple, *Acer rubrum*, and river birch, *Betula nigra*. There is a well developed shrub layer of fetterbush, *Leucothoe axillaris*, highbush blueberry, *Vaccinium corymbosum*, and ironwood, *Carpinus caroliniana*, on slight elevations, which are very moist

but above water during most of the year. These shrubs are intertwined with vines of *Smilax herbacea*.

Where the shrub layer is absent, there are patches of rushes, *Juncus acuminatus* and *Juncus elliotti*, as well as scattered clumps of the sedge, *Carex intumescens*. Large patches of sphagnum moss covers the mud between these clumps of grasses. There are branches and rotting logs everywhere in the swamp.

Birds found in the swamp are typically those of southern swamplands. They include chuck-will's-widow, *Caprimulgus carolinensis*, prothonotary warbler, *Protonotaria citrea*, hooded warbler, *Wilsonia citrea*, Kentucky warbler, *Oporornis formosus*, Louisiana water thrush, *Seiurus motacilla*, yellow-breasted chat, *Icteria virens*, blue-gray gnatcatcher, *Polioptila caerulea*, Carolina wren, *Thyrothorus ludovicianus*, Carolina chickadee, *Parus carolinensis*, and the tufted titmouse, *Parus bicolor*.

Meanley (1951) discussing the carpenter frog in Maryland stated: "...This is but one of a number of Austroriparian animals and plants that occur in the Pocomoke Swamp. Some other examples are Swainson's warbler, *Limnothylypis swainsonii*, red bay, *Persea borbonia*, horse sugar, *Symplocos tinctoria*, cross-vine, *Bignonia capreolata*, and bald cypress, *Taxodium distichum*."

Thus far none of these species has been found in the US 301 region of the Mattaponi-Polecat Creek Swamp. All of the plants and animals studied so far indicate that the swamp is located in the Carolinian division of the Upper Austral Zone (Murray, 1952).

Plant names used in this paper follow Radford, et. al., (1964) and specimens of these plants have been placed in the herbarium of Randolph-Macon College. Names of reptiles and amphibians follow Conant (1958) and those of birds follow Murray (1952). Specimens of reptiles and amphibians collected have been deposited in the collection of the United States Museum and Randolph-Macon College.

It would be most helpful if herpetologists from other States who collect the Caroline County area (or any other area in Virginia) would send a report on their collections to the Virginia Herpetological Society. The Society is gathering data for a series of publications on the herpetology of the state and would welcome reliable data from any source.

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—John B. Funderburg, *Department of Biology, Randolph-Macon College, Ashland, Virginia 23005.*
Present address: *North Carolina State Museum of Natural History, Raleigh, N. C. 27611.*

Received 12 June 1974
Accepted 24 July 1974

A RANGE EXTENSION FOR THE CARPENTER FROG, *Rana virgatipes* COPE, IN THE CHESAPEAKE BAY REGION

The carpenter frog, *Rana virgatipes*, has been called a "coastal plain endemic" (Conant, 1947). In the Chesapeake Bay region, (Fig. 1), it has previously been known only from three counties in Maryland (1), all located on the southern part of the Eastern Shore (Meanley, 1946; Harris, 1959), and from the Dismal Swamp Region (4) in Virginia (Werler and McCallion, 1951; Tobey, 1974). The only other record for the species in the Bay area was a questionable verbal report of this frog from Stafford County (5), Virginia (Tobey, 1973a.).

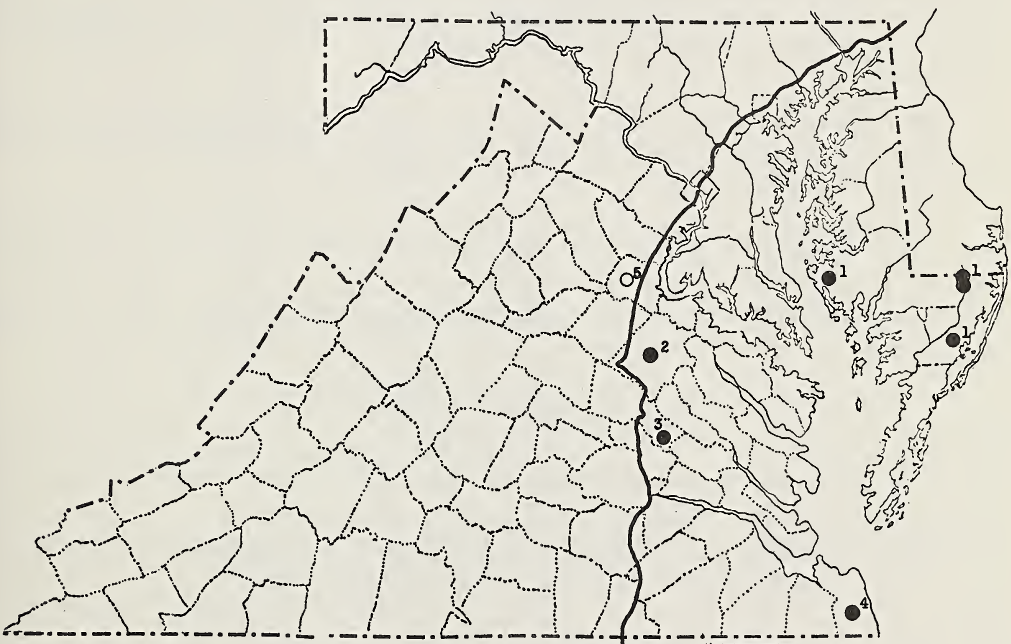

Fig. 1. Distribution of the carpenter frog, *Rana virgatipes*, in the Chesapeake Bay Region (● - specimen record, O - questionable record).

In June 1973, Dr. Roger Conant wrote Mr. Franklin J. Tobey, Secretary of the Virginia Herpetological Society and Herbert S. Harris, Jr. about an early voice record of the carpenter frog from Virginia. Dr. Conant wrote: "Dr. Ann Pace, a recent Ph. D. from Michigan (Ann Arbor), now teaching at Queens College, tells me she has a tape recording of this species from Caroline County, Va. It was taken on April 13, 1967, about 8 miles south of the junction of U.S. Rt. 301 and Va. Rt. 2 and about a mile south of the Mattaponi River and Polecat Creek. The tape is in the sound library at Ann Arbor." Mr. Tobey notified the senior author and Harris notified Jerry D. Hardy of the Chesapeake Biological Laboratory, Solomons, Maryland of this record and suggested that attempts be made to secure specimens (Tobey, 1973b, Harris, 1974). Jerry D. Hardy (1973) and the authors have now secured specimens from this locality (10 July, 1973 and Fall, 1973 respectively). Specimens are on deposit in the National Museum of Natural History (USNM 195859 - Hardy, 1973) and the senior author's collection.

In March and April 1974, we studied the habitat of the Caroline County carpenter frog population (2) and made an intensive search for these frogs in the eastern part of Hanover County, which also lies in the Coastal Plain. On 28 April, we heard two carpenter frogs calling on Crump Creek where the creek crosses State Road 605 (3). On 30 April, 1974, we collected two carpenter frogs at this locality. One of these frogs has been deposited at the United States National Museum, and the other in the senior author's collection.

These localities not only represent a significant range extension for the carpenter frog in the Bay area, but are also important in that both are within ten miles of the Fall Line (Figure 1).

Interestingly enough, we have secured the only specimens of the wood frog, *Rana sylvatica*, known outside the mountains of Virginia at these same two sites (Funderburg, Hotchkiss and Hertl, 1974). This is not a result of limited collecting, as we have made an intensive study of the herpetofauna of this section of Virginia over the past three years.

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—John B. Funderburg, Peter Hertl and William M. Kerfoot, *Department of Biology, Randolph-Macon College, Ashland, Virginia.*

Present address: *(Senior author) Director, North Carolina State Museum of Natural History, Raleigh, N.C. 27611.*

Received 12 June 1974

Accepted 24 July 1974

AN *Aneides aeneus* NEST IN WEST VIRGINIA

Little is known of the biology of the green salamander, *Aneides aeneus*, in the northern portion of its range. This species is currently afforded rare and endangered status in Maryland and, since information concerning all aspects of its life history is desirable for effective management, the following note is of interest. On 4 September 1972, while observing the large colony of *Aneides* in Cooper's Rock State Forest, Monongalia County, West Virginia (Netting and Richmond, 1932), we found a single female attending a group of newly hatched young. The adult (54 mm snout-vent) was loosly coiled around the young, which were noticed only after the female had been removed from a long, narrow (15mm), horizontal crevace in a large sandstone mass. The crevace was heavily shaded by great laurel, *Rhododendron maximum*, but was not particularly damp. The young were extremely active and could not be collected. Four hatchlings were noted but more may have been nearby. In North Carolina this species lays from 10 to 26 eggs (Gordon, 1952) and Lee and Norden (1973) found that adult females from this same West Virginia population contained from 20 to 32 unpigmented eggs in May.

When the crevace had been cleared of salamanders a deteriorating egg mass was found on the floor of the cavity about three inches from the entrance. It was not tightly attached and, when removed, was found to contain one additional salamander which was embedded in the matrix but not coiled within an egg membrane. The salamander died soon after collection and has been deposited in the collection of the Natural History Society of Maryland. It measures 19.1 mm in total length and has the stomach noticeably distended with yolk. There seems to be an unnatural curvature of the spine in the pelvic region which may have prevented normal hatching.

The conditions under which this nest was found agree well with the information recorded by Gordon (1952) from his studies of *Aneides aeneus* in North Carolina. Numerous other adult salamanders were observed on this same day but no other hatchling salamanders or signs of nests were noticed. This meager data suggests that the hatching and, subsequently, the mating and egg laying time for this species in West Virginia and Maryland are the same as they are in the southern parts of its range.

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NOTEWORTHY HERPETOLOGICAL RECORDS FROM NORTH CAROLINA

Since the publication of A Field Guide to Reptiles and Amphibians (Conant, 1958), we have assembled from North Carolina notable records, range extensions, or revisions for 14 species and subspecies (five salamanders, one toad, four frogs, and four snakes). So that these records may be included on the maps in Dr. Conant's forthcoming revision of the Field Guide, and in an effort to stimulate others to report significant records from the state, we submit the following annotated list.

Specimens included are contained in the American Museum of Natural History (AMNH), Charleston Museum (ChM), Duke University (DU), Louisiana State University Museum of Zoology (LSUMZ), National Museum of Natural History (USNM), North Carolina State Museum of Natural History (NCSM), University of Michigan Museum of Zoology (UMMZ), and University of North Carolina at Wilmington (UNCW).

Siren intermedia intermedia LeConte. Collette and Gehlbach (1961) first recorded this aquatic salamander in North Carolina from one locality each in the Cape Fear, Neuse, Pee Dee, and Waccamaw river systems. Other specimens have been reported in the Neuse (Bruce, 1971) and Pee Dee (Hardy, 1969a,b) drainages. Lesser sirens now are available (DU, NCSM) from various localities in all of these systems; however, only marginal inland records and one new drainage record are listed:

Bertie County.— Roanoke drainage, Hoggard Mill Cr., 6 mi. NE Windsor (NCSM 13242). Harnett County.— Cape Fear dr., 0.75 mi. NNE Lillington (NSCM 13325-26(2)). Johnston County.— Neuse dr., Holt's Lake, near Smithfield (NCSM 11834(3), 12873(2), 13307). Moore County.— Pee Dee dr., 6.2 mi. WSW Pine Bluff (DU A8965); 4 mi. S Pine Bluff (DU A8966). Richmond County.— Pee Dee dr., Broadacres Lake, 1 mi. S Hoffman (DU A4178, A6264-65(2)).

The specimen from Bertie County represents the first record of the species from the Roanoke drainage, and extends the range approximately 75 airline miles north of the nearest reported locality in the Neuse system (Bruce, 1971), and about 40 airline miles south of the Nasemond-Southampton counties, Virginia border.

Ambystoma mabeei Bishop. Since its original description (Bishop, 1928), there have been few reports of specific localities for *A. mabeei* in North Carolina. Bishop (1943) reported a specimen from near Wilmington, presumably in New Hanover County. Populations subsequently were recorded on Roanoke Island, Dare County, and from the Laurinburg-Maxton area, Scotland County, by Hardy (1969a, b), who provided the only life history information for the species. Hardy and Olmon (1974) later reported larvae from one locality each in Bruswick, Columbus, and Scotland counties.

Since *A. mabeei* apparently remains poorly known, and because specimens are rare in most collections (Hardy and Anderson, 1970: 81.2), all unreported North Carolina records known to us are listed:

Bertie County.— 2 mi. N Windsor (ChM 56.65.1). Bladen County.— town of White Lake vicinity (DU A626-29(4), A631 (97 larvae), A2109, A6220-22(3); 1 mi. NW Council (DU A2110-11(2)). Brunswick County.— 13.5 mi. SW Shallotte (ChM 55.15.2(2)); 1.7 mi. SE Supply (ChM 55.15.3); 6 mi. NNW Supply (LSUMZ 7086). Carteret County.— Newport vicinity, Croatan National Forest (ChM 53.171.13(2), NCSM 1147-49(3), 9102-05(4)). Columbus County.— near Old Dock (DU A6118); 13-18 mi. S Hallsboro (DU A6223); 7.5 mi. S Bolton (NCSM 9234 (5 larvae)). Cumberland County.— near Linden (NCSM 13075, 13121). Dare County.— Roanoke Island (NCSM 1900-03(4)). Jones County.— 5.1 mi. S Pollocksville (ChM 53.174.18(2)). New Hanover County.— 10 mi. N Wilmington (NCSM 1145); near Seabreeze (NCSM 4282-83 (female and eggs)); near Wilmington (NCSM 6084, UNCW SA251(7), SA252(4), SA253(2), SA255). Perquimans County.— 4 mi. NE Belvidere (NCSM 1146). Richmond County.— 3 mi. N Hamlet (ChM 56.76.13 (4 larvae)). Robeson County.— Maxton (USNM 138534). Sampson County.— 1 mi. S Delway (NCSM 13704 (8 larvae)). Scotland County.— 5 mi. SE Hoffman (ChM 56.76.18); Laurinburg vicinity (NCSM 3746-47(2), 7312-14(3), 11185 (8 larvae)); near Maxton (NCSM 3742-43(2)); 3.75 mi. SW Wagram (NCSM 11045).

The specimen from Perquimans County, found beneath a board near a sawdust pile in pinewoods, extends the range north of Albermarle Sound and less than 20 airline miles south of the Nasemond County, Virginia border.

Ambystoma tigrinum tigrinum (Green). The occurrence in the state of the eastern tiger salamander currently is based on literature records from seven counties (Brimley, 1907, 1915, 1944; Eaton, 1953; and Hardy, 1969b), all of which probably are valid but only one of which (Hardy, 1969b) is corroborated by a specimen. Because this species is fossorial and usually active on the surface only at night during a short breeding period in winter, its presumed rarity may be more apparent than real. Despite recent intensive efforts, however, *A. tigrinum* has been collected from few localities:

Richmond County.— 2 mi. N Hamlet (NCSM 12519). Robeson-Scotland County line.— Laurinburg-Maxton Air Base vicinity (NCSM 4790). Scotland County.— Laurinburg vicinity (NCSM 6173 (eggs and hatching larvae), 6174 (larvae), 6182-83(2), 7319-23(5), 11020-21(2), 11030 (larva)); 10 mi. NW Wagram (NCSM 11024-27(4)); about 3.5 mi. NW Wagram (NCSM 12443 (15 larvae), 12447 (4 larvae)).

Neoteny is rare in this subspecies and larvae usually metamorphose at 45-85 mm snout-vent length (Gehlbach, 1967:52.1-52.2). However, NCSM 11030 is neotenic in that transformation obviously has been delayed and the specimen has retained all external larval characters. Whether it is sexually mature is not known. When fresh, and before fixation in formalin, this specimen measured 190 mm total length. After more than two years in solution, it measures 102 mm snout-vent length.

Pseudotriton ruber ruber (Latreille). The status of the northern red salamander in eastern North Carolina is uncertain. There are few records and most earlier reports probably resulted from misidentified specimens of *P. montanus* (Brimley, 1917; 1918). Bishop (1943) excluded the red salamander

from the Atlantic Coastal Plain south of northern Virginia, although Dunn (1926) earlier recorded a specimen from Goldsboro. Funderburg (1955) reported two specimens from New Hanover County, but Conant (1958, Map 188) excluded the species from the extreme southeastern Coastal Plain while depicting its range over the remainder of the state. While many specimens are preserved from localities along the Fall Line (DU, NCSM), we have located only three individuals from the Coastal Plain, two of which are from the Sandhills along the southwestern periphery of the province. Additional specimens are much desired.

Moore County.— 7.5 mi. W Aberdeen (NCSM 4997). Scotland Co.— outlet of Scotland Lake, about 10.75 mi. NW Wagram (DU A4187). Wayne County.— Goldsboro (USNM 8339). This specimen was reported by Dunn (1926) as USNM 8839; the number was later changed because of a duplication in the USNM catalog (R. Crombie, *pers. comm.*).

Manculus quadridigitatus (Holbrook). The dwarf salamander is typically a species of the Coastal Plain, invading the extreme eastern Piedmont as far north as Raleigh, Wake County (Mittleman, 1967:44.1-44.2). An adult (NCSM 12434) from 0.9 mi. E Pittsboro, Chatham County, extends the range about 25 airline miles inland; and three adults (NCSM 9797, 12866(2)) from 2.5 mi. SSE Badin, Stanly County, represent a range extension into the interior southern Piedmont about 85 airline miles WSW Raleigh.

Bufo fowleri Hinckley. Although Funderburg (1955) reported this toad as common in New Hanover County, Conant (1958, Map 211) later excluded it from the southeastern corner of the state. In our experience, *B. fowleri* is rare in extreme southeastern North Carolina whence only nine specimens have been located, all from the vicinity of Wilmington, New Hanover County (AMNH 21363-64(2), ChM 51.44.8(7)). Other more northern southeastern records are:

Bladen County.— White Lake (DU A380-81(2), A427, A823); 1 mi. NW Council (DU A4371); 7.5 mi. NNE Carvers (DU A5162); about 9.25 mi. ESE Carvers (DU A6378); 7 mi. N Elizabethtown (NCSM 5352); 3 mi. ESE White Oak (UMMZ 129113-14(2)). Onslow County.— 6.5 mi. NW Verona (DU A2324 (2)); about 3 mi. NW Haw (DU A2353); Camp Davis at Holly Ridge (UMMZ 91952). Pender County.— Topsail Island (DU A2364(5)).

Hyla femoralis Latreille. This tree frog, occurring throughout the Coastal Plain (Conant, 1958; Map 220) where it is locally abundant, has been collected in the Piedmont from Chatham County at the B. Everett Jordan Reservoir (under construction) near Farrington (NCSM 11383, 11603-04(2)), and 1.75 mi. WNW Wilsonville (NCSM 11665).

Hyla gratiosa LeConte. Although generally considered a species of the lower Coastal Plain (Conant, 1958; Map 227), this large hylid is now known from several localities in the interior Coastal Plain and eastern Piedmont, the most marginal of which are listed:

Franklin County.— 1.5 mi. NW Pilot (NCSM 11530). Greene County.— no precise locality (NCSM 3521-24(4)); 3 mi. E Snow Hill (NCSM 11401). Harnett County.— 2.5 mi. E town of Buies Creek (NCSM 7779-80(2)). Johnston County.— Clayton (NCSM 3433). Richmond County.— 1 mi. W Norman (DU

A2283). Wake County.— 6.5 mi. SW Raleigh (NCSM 6472); 5.25 mi. WNW Raleigh (NCSM 13862). Other specimens were observed but not collected by Dr. A. J. Bullard (*pers. comm.*) in Harnett County about 1 mi. E Pineview, and in Montgomery County 1.5 mi. ESE Emery.

Hyla squirella (Latreille). The distribution of this hylid in the state is similar to that of *H. femoralis* (Conant, 1958; Maps 220 and 223). Noteworthy records from the Piedmont and from marginal Fall Line localities are:

Chatham County.— Near Merry Oaks (NCSM 13893-94(2)). Franklin County.— 1 mi. SE Riley (NCSM 11539). Union County.— Monroe (NCSM 12354-55(2)). Wake County.— Raleigh vicinity (NCSM 445, 7273-75(3)); 5 mi. S Rolesville (NCSM 6590-91(2)).

Rana areolata capito LeConte. Since this species has been reported only from Beaufort (Brandt, 1936) and Jones counties (Schwartz and Etheridge, 1954), all other records known to us are listed:

Bladen County.— 4 mi. ENE town of White Lake (DU A544-45(2)). Brunswick County.— Orton Plantation (NCSM 3091); 16 mi. NE Bolivia (NCSM 4309); near Supply (NCSM 11155). Carteret County.— Newport vicinity, Croatan National Forest (DU A535-43(9), NCSM 9118-19(2)). New Hanover County.— near Carolina Beach (AMNH 62101-03(3), NCSM 3807-16(10), 6150-51(2); Wilmington vicinity (NCSM 7463, 7482-84(3), 7770-74(5)). Scotland County.— 2 mi. SW Wagram (DU A10463); 3.5 mi. NW Wagram (NCSM 12228, 12232-33(2)).

Natrix taxispilota (Holbrook). Although Conant (1958, Map 94) confined the range of this large water snake to the eastern Coastal Plain, *N. taxispilota* also occurs in ponds and lakes of the interior Coastal Plain and in certain rivers and impoundments of the interior southern Piedmont.

Johnston County.— Stewart's Pond, 7.25 mi. SSW Smithfield (NCSM 10868). Mecklenburg County.— Charlotte (NCSM 2660). Moore County.— 5 mi. S Carthage (DU R1227). Scotland County.— 7 mi. W Wagram (NCSM 11229). Stanly County.— Lake Tillery, 3.5 mi. SE Badin (NCSM 9216 (skin only), 9323, 10359). Wilson County.— Silver Lake, near Wilson (NCSM 3192).

Micrurus fulvius fulvius (Linneaus). Conant (1958, Map 141) outlined the range of the eastern coral snake throughout the Coastal Plain south of Albemarle Sound. This species has been collected, however, only in the southern Coastal Plain. The most inland record, which probably is erroneous, is Wilson County (Brimley, 1944). According to information available to us, this record was based upon a snake seen but not collected by a layman and unfortunately accepted by Dr. Brimley. In North Carolina, the distribution of *M. fulvius* is closely associated with that of the sandy pine and scrub oak community which extends north along the coast at least as far as Neuse River. However, the northernmost acceptable record is that of a coral snake seen but not collected in Onslow County near the mouth of New River by Harry T. Davis, former director of the State Museum of Natural History. This locality is approximately 125 airline miles southwest of Albemarle Sound. Along the southern border of the state, the distribution extends inland into the Sandhills about as far north and west as southern Harnett and Moore counties. All localities supported by specimens were plotted by Palmer (1974).

Agkistrodon piscivorus piscivorus (Lacépède). As indicated by Conant (1958, Map 143), the range of the cottonmouth in North Carolina extends throughout the eastern Coastal Plain with an isolated record at about the Fall Line. This interior record probably was based on a snake killed in 1891 along the Neuse River near Raleigh, Wake County (Brimley, 1895). Our few recent records extend the range inland into the eastern Piedmont and along the Fall Line:

Franklin-Warren County line.— Shocco Cr., 2.5 mi. NE Wood (NCSM 14109). Johnston County.— Lake Wendell, 3 mi. NE Archer Lodge (NCSM 2392-93(2), 2658). Wake County.— Buffalo Cr., 4 mi. E Knightdale (NCSM 7293). Warren County.— about 4.5 mi. NW Littleton (NCSM 10255); about 6.5 mi. NE Macon (NCSM 12014).

The two specimens from Warren County were collected along Lake Gaston, an impoundment of Roanoke River, at localities approximately three to four airline miles south of the Brunswick County, Virginia border. All localities supported by specimens were plotted by Palmer (1974).

Crotalus adamanteus Beauvois. Based on earlier unsupported records from Albemarle-Pamlico Sound Peninsula and vicinity (Brimley, 1944), the distribution of *C. adamanteus* in the state has been incorrectly stated by most later workers. Reports of this species from Beaufort, Tyrrell, and Washington counties (Brimley, 1944) were received from various lay observers and probably were based on misidentified specimens of *C. horridus atricaudatus*, a form which is common in the region and which is frequently confused by residents with *C. adamanteus*. Excluding a specimen (USNM 252) reputedly from Jackson, Northampton County, but probably cataloged in error or collected elsewhere and sent to the Smithsonian from Jackson (Brimley, 1944), the most northern locality for *C. adamanteus* is the vicinity of New Bern, Craven County (NCSM 2274, 9844, 10500). All localities supported by specimens were plotted by Palmer (1974).

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Death-Feigning in *Hyla regilla* on Santa Cruz Island Santa Barbara County, California

On the west slope of Santa Cruz Island, Santa Barbara County, California, populations of what Jamison, Mackey and Richmond (1966) described as *Hyla regilla deserticola* are extremely common in many of the steep-walled V-shaped stream beds. Adults were heard on 10-13 May 1974 and many tadpoles of various developmental stages were observed in various intermittent pools which were very common.

Tree frogs were extremely widespread and abundant on Santa Cruz Island. Of 4 arroyos in the central portion of the Island which I followed along most of their main course, only 1 small one did not contain observable tadpoles or adults near or around the intermittent pools along its main course. In the stream bed just to the south of the frogless one, I made the following observations:

On 11 May 1974 I was making ecological observations in a dry arroyo on the southwest side of Santa Cruz Island. There were 8 ephemeral pools of varying sizes along the almost straight east to west course of the stream bed. I spotted an adult *Hyla regilla* on a prickly pear cactus (*Opuntia* cf. *littoralis*) pad overhanging approximately 1.3 meters above a 1 meter wide "perfect triangular" shaped pool. The tree frog had a green border with a light gray mid-trunk. The cactus pad was 1 of 3 branching horizontally from a stem pad which appeared to be precariously rooted to the steep almost vertical rock wall. This animal did not move when I placed a wooden stick point over and around it on each side, front and rear. Nor did it appear to move when I dangled a fish line noose over and around it. I gained the quick impression that the tree frog had desiccated *in situ* on the cactus pad or even that it had perhaps become impaled by cactus spines. That these alternative explanations were not valid was soon demonstrated as I tried to grasp the animal with my fingers. The frog then jumped quickly into the pool below. This observation supports a hypothesis that death-feigning behavior does indeed on occasion occur in Santa Cruz Island *Hyla regilla*. I have not made comparable observations in any mainland populations although I have attempted comparable experiments with numerous individuals occurring in my vegetable garden in Solana Beach.

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THOMAS BAILLIE MACDOUGALL, NATURALIST-COLLECTOR, 1896-1973

Hobart M. Smith

One of the most enterprising naturalist-collectors of all time, in Mexico, became history on January 17, 1973, when Thomas Baillie MacDougall died in Oaxaca, Oaxaca, Mexico. The ashes of Don Tomás, as he was often addressed in affectionate recognition of his sage maturity, and, by his English-speaking friends, for his exotic way of life, were buried in the city cemetery of Tehuantepec, far from his birthplace in Scotland but in the land he grew to love, by his closest Indian friends, Francisco Ortega (a Zapotec) and Juan Ramírez (a Chontal).

Indeed, in general terms Don Tomás had three homes. He migrated from Scotland, where he was born (probably on the island of Bute) Dec. 9, 1896, to the United States after the first World War, in which he served in the British Army, and became a naturalized citizen. He completed most requirements for a degree from the New York State College of Forestry, but did not actually receive the degree, being deficient in the required formality of one season at the Forestry Summer Camp. Subsequently he became associated with a classmate, William Shemin, who established a commercial greenhouse and nursery in the Bronx, New York, later moved to Greenwich, Connecticut. Tom directed the landscaping, propagation and horticultural aspects of the business, leaving sales and administration to his partner. He was never a co-owner, but shared in the success of the enterprise, and in the freedom it offered during the "off-season." It soon became his custom to spend several fall, winter and spring months in Mexico while his friend ran the business, and then he would return to supervise cultural activities from April or May to September or October. It was an eminently satisfactory arrangement which, although allowing no chance for accumulating a personal fortune, was deeply satisfying to both partners. It was an arrangement which did require careful husbanding of all resources. Frugality became a regular way of life, for example in travel only by bus, whenever he had to use public transportation. He never owned or drove a car or other personal vehicle.

As time went on Don Tomás spent progressively less time with the business, and by 1955 had retired fully from it, spending some 9 mo. each year in Mexico, collecting both plants and animals for various museums and universities, as well as for some pharmaceutical companies. He also collected some archaeological material. Live material posed some minor problems at the border, on occasion, but the quantity of material was so insignificant that with his meticulous, neat packing he never encountered real problems despite the increasingly stringent restrictions upon importation. We regularly marveled at his unique efficiency in bringing live birds, reptiles and plants as well as preserved material across the border.

Because of his efficiency in penetration of the most remote regions, he served in some role, perhaps largely unofficial, in exploration for sources of scarce, critical materials during World War II, and in undercover monitoring of international activities near the Guatemala-Mexico

border. These roles are not well known, and likely never will be. In the most recent years Don Tomás became intimately involved with preservation and professional exploration of unique, irreplaceable archeological sites that abound in Oaxaca but are regrettably open for pilfering and vandalism. At the time of his death he was negotiating for special attention to the famed sites on Mt. Guiengola, near Tehuantepec. In these endeavors he was particularly closely associated with Dr. David A. Peterson of the Department of Anthropology of the New York State University at Binghamton, working with the Institute of Oaxaca Studies. A joint work on Guiengola is in progress and will be completed by Dr. Peterson.

Don Tomás never married. His time and energy were expended in exploration of remote regions. In his early trips to Mexico he travelled rather widely in southern parts from Veracruz to Guerrero and south to Chiapas. In later years, however, he focussed upon the Oaxaca-Chiapas area, making headquarters in the Hotel La Perla (in later years, in the Hotel Istmo) in Tehuantepec and the Hotel Principal (where he died) in Oaxaca. From these sites he would strike out in 1-3 week forays into the hinterlands, in the company usually of one to three close friends who maintained small farms near Tehuantepec.

His travels were largely on foot, shunning use of pack or saddle animals. He would go by bus to the nearest point of departure for any given trip, then walk for days in exploration of roadless, often trailless and and largely uninhabited fastnesses. His pack was astonishingly light; in his early days, he would use newspapers for cover at night as in the crater of Volcán Tacaná, but in later years he adopted the luxury of a small tarpaulin or plastic sheet to serve as a shelter, and a down sleeping bag. The travelers carried a minimum of food, and would extensively live off the land, occasionally buying a chicken from a local rancher. Few Americans could keep up with him very long, although occasionally they would try, usually with prompt failure. He seemed indefatigable - the epitome of the notoriously tough, wiry Scot. He was in this sense a rare field companion for his durable Indian friends, who developed a deep affection over the years for this strange naturalist who worked with them in their own haunts and indeed led them farther afield than they would ever have gone otherwise.

Travelling so light, he could save only a small part of the animals and plants of special interest. It is a source of despair that he could not have been accompanied by skilled collectors in all fields, for although he was a widely knowledgeable botanist, he was marginally familiar with animals. His travels took him into many endemic sanctuaries never before visited by collectors, and which will likely not be well sampled for decades. Like any observant naturalist, he knew the conspicuous vertebrate types - birds, game animals, deadly snakes, etc. - but he had no knowledge in depth of any animal group. Nevertheless, he early developed a zeal for sampling those animals and plants that were most desired by taxonomists with whom he had contact, especially in the American Museum of Natural History (Dr. George C. Goodwin), and the New York Botanical Gardens (Dr. Ed Alexander, Dr. Howard Irwin) and that were not too difficult to prepare as specimens. He thus came to concentrate primarily upon small mammals and herps as subsidiaries of plants.

Dr. Goodwin came to be his sole beneficiary for small mammals, and through a coincidental encounter in Tehuantepec in 1939 I became his beneficiary for herps. Despite strong appeals by others to collect those animals for them, he refused, feeling that it would be unfaithful to his friends. For indeed we beneficiaries did become his friends, poring over his pictures, specimens, notes and rare acquisitions of varied sorts as he would stop briefly on his trips to the northeast, or on his way to Mexico. The specimens were purchased from him at a nominal figure ($1.00 each for the herps), most of which was turned over to his field companions.

In time Mr. MacDougall developed numerous contacts with botanists all over the country and in Mexico, securing for them material of especially desired groups. Some met him in Oaxaca and travelled briefly with him. Dr. Margery Carlson and Kate Staley, for example, first travelled with him in 1949, to Monte Bello near Comitan, Chiapas, and were subsequently frequent field companions. However, he led too tiring a pace for most, except when he consented to travel with them for brief periods by car or bus. He was essentially a "loner" with respect to his colleagues, despite his friendly contacts with them; these were casual, whereas he treasured his intimacy with the native Indians, and they regarded him reciprocally.

Unfortunately Don Tomás recorded much less than might be desired about his travels. Most extensive is a illustrated article in the Explorer's Journal (1971, vol. 49, no. 2, pp. 86-103, "The Chima Wilderness"), containing a map denoting some localities where he secured specimens in this area. His voluminous notes and photographs have been deposited by his official executor, Mr. Emanuel Shemin, in the library of the American Museum of Natural History, however, where they can be consulted by specialists in the future. Nevertheless the vast bulk of his unique observations and experiences will remain unrecorded.

Among the few amazing discoveries preserved in his Chima article is the notation of the incredible vegetation of Cerro Azul with an "elfin forest" so dense and beaten by wind and rain that it is easier in many places to walk on top of it rather than through it. From remote areas such as these he brought out many novel forms of life, tantalizingly leading to speculation on what enormous diversity may remain to be discovered there when with his limited forays he could reveal so much. It is to be hoped that these incomparably complex ecosystems may be spared for biological study in depth before they are destroyed by the wanton exploitation that is sure to come in due time if the areas are not set aside as sanctuaries. Indeed this was very much in mind when Mr. MacDougall wrote the Chima article, giving notice in his quiet way that here is a region unique in its complexity and pristine integrity that should be preserved somehow for all time. If that protection were not given, it was his aim to provide some indication of what it was like before it was destroyed.

Despite the largely casual collecting of herps that he carried out, the continued acquisition over a period of 40 years led to an astonishing accumulation, bolstered considerably by the acquisitions of local farmers with whom he would leave cans of formalin. The total would come to approximately 10,000-15,000 specimens, since between 200 and 500/year were saved. He and his collectors became familiar with common species and

preserved few of them, concentrating upon unusual-appearing specimens. It is likely that his material represented, when collected, at least 100 then undescribed species, of herps alone. Eight bear his name: *Gaigeia dontomasi* (lizard), *Thorius macdougalli* (salamander), *Eleutherodactylus macdougalli* (frog), *Sceloporus macdougalli* (lizard), and four snakes: *Bothrops nigroviridis macdougalli* (a pit viper), *Micrurus diastema macdougalli* (a coral snake), *Rhadinaea macdougalli*, *Tropidodipsas macdougalli*. Few herpetologists have collected so much novel material, or had so many distinct kinds named for them.

Thus the impact of Thomas MacDougall's activities upon Mexican Herpetology is prodigious, for the state of that knowledge was notably primitive when he entered the field - about where the United States was in the mid-19th century. Mexico is now known about on a par with U.S. in the early 20th century, and Don Tomás figured very importantly in that phenomenal growth. It is likely that future maturation of knowledge of the Mexican herpetofauna will maintain a much slower rate, as much because of the absence of one of its great naturalists, Thomas MacDougall, as because of the lessening accessibility to American workers.

Obituaries written by his botanical associates (Helia Bravo Hollis, in Cactáceas y Suculentas Mexicanas, vol. 18(2), 1973, p. 53; also in Macpalxochitl of the Sociedad Botanica de Mexico, no 47, 1973; Rudolf Ziesenhenne, in The Begonian, vol. 40, 1973, pp. 126-127) reveal that however major his herpetological contributions may have been, his botanical ones were much greater. Many of his plant discoveries were named for him. He described one species by himself, and several were coauthored. Alone or with collaborators, he published some 90 brief articles after 1940, calling attention to rare or noteworthy species, especially their taxonomy, natural habitat and growing conditions. Most of these articles were illustrated with his own photographs. It is likely that his mammalogical contributions were on a par with his herpetological ones, and he even prepared some outstanding bird skins for various museums. Occasionally he preserved fishes and insects, sent in with his reptiles or mammals. At least one coastal marine fish was the subject of a note grossly extending the known range of its species. So far as I am aware, his herpetological collections were (before exchanges) limited to the American Museum of Natural History, the U. S. National Museum, the University of Colorado Museum, the Edward H. Taylor private collection and the Museum of Natural History of the University of Illinois. The latter collection is the largest of all, and the dispersal to all of the named collections, except the first, is a product of my own changing affiliations, not to shifting arrangements on the part of Mr. MacDougall. All of the Taylor collection is now in the Field Museum in Chicago (2/3) and at the University of Illinois (1/3).

With such varied contributions of broad biological import over such a long period, Thomas MacDougall will remain a figure etched forever in the annals of biological exploration in Mexico - a record that stands unique in the 20th century and is not likely ever again to be matched. He will also be remembered, lamentably for a briefer time, as a gentle person of reserved warmth and unswerving loyalty, who opened his heart to those who shared with him, directly or indirectly, the simple but deeply satisfying pleasures of learning to know a remote region as yet largely untouched by the heavy hand of man.

Hotel Istmo,
Tehuantepec,
Oax

Dear Hobart. Nov. 16, 1967

I forgot to mention the chachalaca head. After I left here, last June, Juan brought in one. It is still in Chico's house, and I am hoping some friendly naturalist will offer to take it along. For las dudas, I think we should have an extra?

Those caecilians seem a little out of our ken. Did we ever collect them? Maybe I can get some common names from don Miguel, so that at least I may ask for them by name.

Three days ago I was at Río Sal. In the <u>woods</u> there we came upon a Xenosaurus, at the entrance to its space between horizontal slabs of rock. The collections were made in partially cleared areas. Juan is positive that they saw Xenosauras, above Zanatepec, <u>only</u> on trees.

In your Check List I note an <u>R. binfordi</u> It escaped us?

With kindliest <u>regards</u>, Sin<u>cerely</u> D. Tomás

Fig. 1. Facsimile of a letter from Mr. MacDougall, illustrating his remarkably beautiful penmanship and his field observations. The chachalaca head was obtained for study of the brain by one of my students at the time, now Dr. R. G. Northcutt. The caecilians were desired for the same purpose. The *Xenosaurus* from Rio Sal has since been described as *X. grandis agrenon* King and Thompson, and the one from Zanatepec as *X. arboreus* Lynch and Smith (now *X. g. arboreus*). He notes that he did not collect *Rhadinaea binfordi* although he worked in the area of its type locality; actually he had indeed secured specimens of it for us at an earlier time, but we had failed to recognize it as distinct.

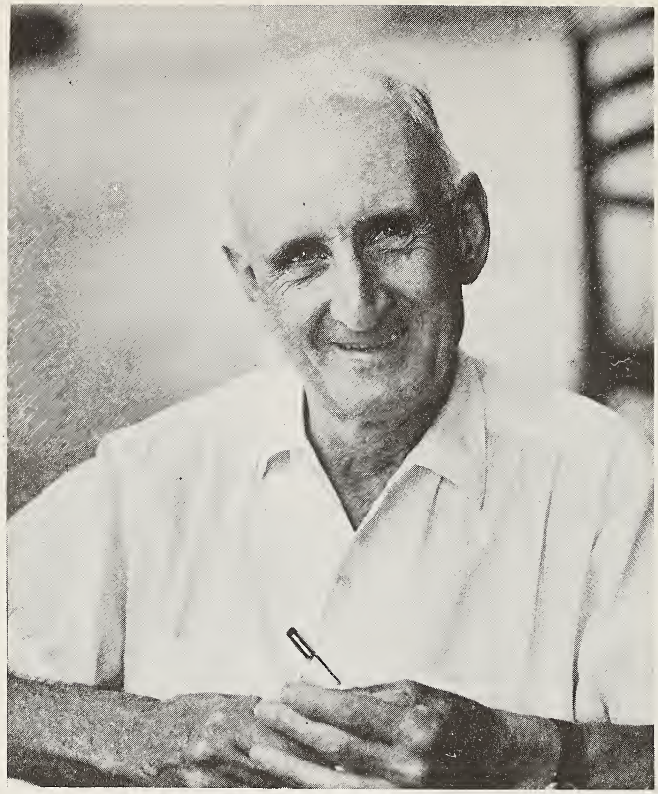


Fig. 2. Mr. Thomas MacDougall, about 1965. Photo courtesy Martin Schweig of St. Louis, through the kindness of Mrs. Ernest W. Stix, Jr., St. Louis.

Acknowledgments. Much of the information presented above has been made available only through the very kindly, unstinting contributions of several of Mr. MacDougall's warmest friends, who uniformly have exhibited a degree of esteem for him that marks a rare human being. Especially am I indebted to Mrs. Judith S. Stix of St. Louis, who is collecting biographical material pertaining to him, and has arranged for a posthumous award to him of an A.B. degree from the New York State College of Forestry in Spring, 1974; and to Mr. Emanuel Shemin, son of Don Tomas' associate William Shemin, of Greenwich, Conn. Also I am grateful for the counsel of Dr. Margery C. Carlson of Evanston, Ill.; Dr. David A. Peterson of Binghamton, New York; Mr. and Mrs. Roy H. Jones of Oaxaca; and Dr. C.M. Bogert of Santa Fe, New Mexico.

Department of Environmental, Population and Organismic Biology, University of Colorado, Boulder, Colorado 80302.

Received 4 June 1974

News & Notes

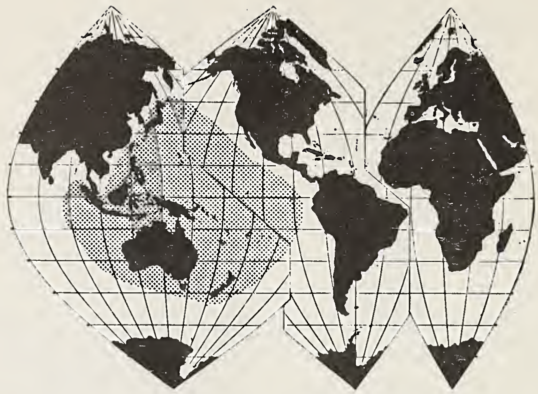
For Immediate Release

As the United States prepares for conversion to the metric system, J. J. Keller & Associates, Inc. announces the publication of the "Metric Manual". This is the first and only such edition in America, and deals with all essential metric data relative to the conversion process.

The deluxe binder edition provides practical background information necessary to understand the full implications of metrication in this country. The "Metric Manual" has required several years of planning and research - and parallels the announcements by several major industries and organizations to convert to the metric system.

Ideal for home and business libraries, the "Metric Manual" is published in loose-leaf, 3 ring binder format and contains: History of Measurement, Development of Metrology, U.S. Metric Considerations, Standards, Government Agencies, Metric Training, Personal Applications, Business Considerations, Industrial Foundation, Professional Concerns, Related Organizations, Foreign Commerce, Measurement Comparisons, Glossary and Appendix.

Copies are available now at a special introductory price of $25 each (postage and handling prepaid, if payment accompanies order), direct from the publisher: J. J. Keller & Associates, Inc., 145 W. Wisconsin Ave., Neenah, Wisconsin 54956.



∷ Loveridge
REPTILES (and Amphibians) OF THE PACIFIC

271 pages, 7 plates, 1 double-page map, index (originally published in 1946 by Macmillan Company, New York)

THIS BOOK treats the herpetofauna of a vast region including Indonesia, the Philippines and Japan, Australia, New Guinea and New Zealand, and an enormous array of islands including Hawaii and the Galápagos. With such isolated land masses, the fauna is predictably diverse and includes the tuatara, several crocodiles, various lizards including the Komodo dragon, flying lizards and the Galápagos iguanas, numerous pythons, the king cobra and other poisonous elapids and vipers, the wide-ranging marine turtles and sea snakes, caecilians, the giant salamander, and many frogs and toads.

Authoritative yet written in a clear and untechnical manner, this book is the standard reference on the Pacific herpetofauna and is equally useful to professionals and amateurs. Each species is described and its range noted, together with a discussion of its life history and remarks on capture, captive specimens, reproductive habits, and use as food. There are identification keys to families and species, illustrated with seven diagnostic plates. Finally, there are chapters on snake bite and its treatment, economic aspects and conservation, collecting techniques, procedures for shipping living and preserved specimens, and an annotated bibliography.

Mr. Loveridge, now retired, was formerly curator of herpetology at Harvard University, and is a noted authority on the amphibians and reptiles of Africa and the South Pacific.

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Orders may be placed now. This book will be published in fall 1974; to take advantage of special prices, SSAR members must place their orders before publication. Please circle edition desired and send with payment to Dr. Henri C. Seibert, Morton Hall, Ohio University, Athens, Ohio 45701, U.S.A. Make checks payable to: "SSAR." Receipt sent on request only.

Please mark these boxes if you want information on SSAR membership ☐ or a complete list of Society publications ☐. Publications issued by the Society include the *Journal of Herpetology, Facsimile Reprints in Herpetology, Herpetological Review, Herpetological Circulars, Catalogue of American Amphibians and Reptiles,* and the several series published by SSAR's predecessor, The Ohio Herpetological Society.

SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES

The Society for the Study of Amphibians and Reptiles is an international organization established to advance the study of amphibians and reptiles. Although begun in 1958 as a regional society, SSAR rapidly gained a world-wide membership, largely because of its diversified publications program, and it is widely recognized to have the most active society-sponsored program of services for students of amphibians and reptiles. Membership is open to all persons, both amateur and professional.

ACTIVITIES

In addition to its publications, SSAR sponsors a number of activities of broad herpetological interest. The annual meeting is held each summer on a university campus or at biological stations throughout the United States since the Society especially wishes to attract students to its meetings by providing inexpensive and

informal facilities. In addition to the papers given by members at these meetings, symposia or other invited speakers are usually planned which allow for detailed discussions of important areas of contemporary study. Live animal, photographic, film and other exhibits are also organized, as well as field trips.

The Society makes a concerted effort in conservation, especially where this affects amphibians and reptiles, by influencing both state and national legislation and by acting as a clearinghouse for communication of conservation information. Likewise, an effort is made to cooperate and provide assistance to regional herpetological groups; as a result, one Society officer is selected from this constituency.

PUBLICATIONS

SSAR sponsors one of the most diversified series of publications of any scientific society. Some are intended for the professional, while others are primarily for amateurs. Each series is described in detail on the reverse side of this page, including some series that have been discontinued. Back issues of every publication are available; a detailed pricelist can be obtained simply by checking the appropriate box on the membership application.

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All persons are welcome to become members of SSAR, to receive its publications, attend meetings and join in other Society activities. All members have voting privileges. Each year they receive these publications as part of their membership: *Journal of Herpetology* (4 issues, totalling about 400 pages), *Facsimile Reprints in Herpetology* (3-4 issues, about 200 pages), *Herpetological Circulars* (1-2 issues, about 50 pages), and *Herpetological Review* (4 issues, about 130 pages).

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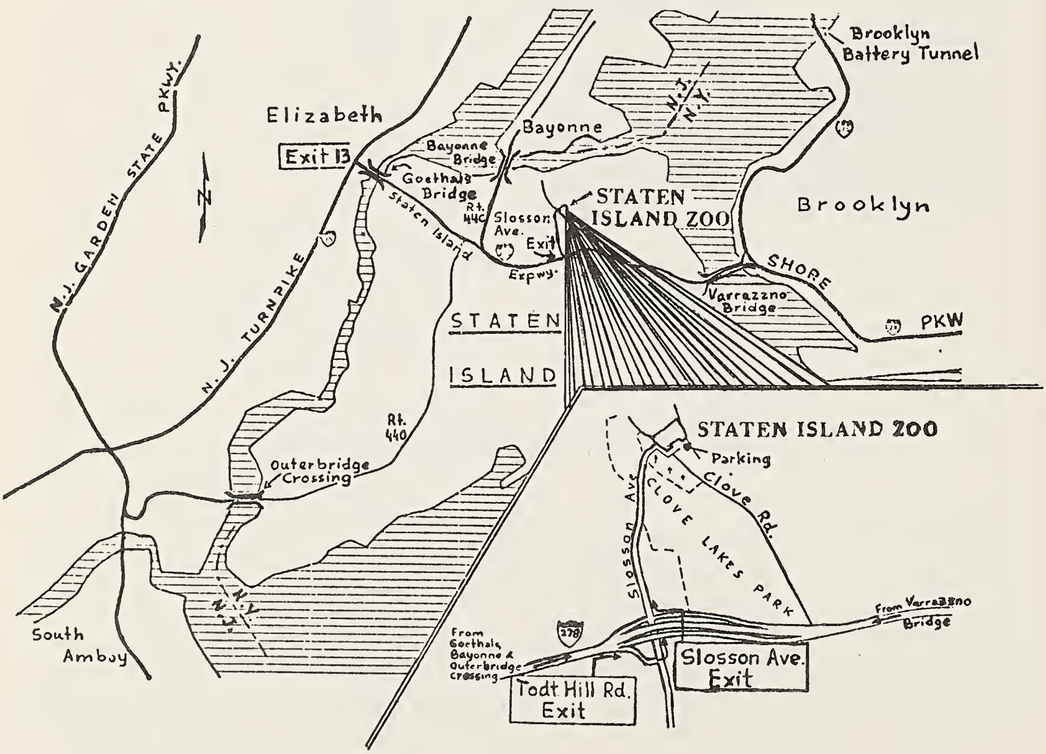
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

OCTOBER 26, 1974 MEETING: EASTERN SEABOARD HERPETOLOGICAL LEAGUE (ESHL)

SPONSORED BY THE NEW YORK HERPETOLOGICAL SOCIETY

SCHEDULE: 12:30 - 1:30 p.m.	Registration, coffee, and final speaker line-up for evening session.
1:30 - 4:15 p.m.	First session topical addresses: INTRODUCTORY REMARKS: Mr. George Zappler, Director and Curator of Reptiles, Staten Island Zoo.
4:15 - 6:00 p.m.	BREAK for dinner, viewing of the SIZ reptile collection, and general socializing. Arrangements are being made at several local eating places to expect us. The reptile wing will be open for our viewing during this time, with staff member Robert Zappalorti on hand to answer any questions.
6:00 p.m.	SPEAKERS FROM REGIONAL SOCIETIES.



Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.05/page.

Information for Authors

All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8½ x 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

Major papers are those over 5 pages (double spaced, elite type) and must include an abstract. The authors name should be centered under the title, and the address is to follow the Literature Cited. Minor papers are those papers with fewer than 5 pages. Author's name is to be placed at end of paper (see recent issue). For additional information see *Style Manual for Biological Journals* (1964), American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016. Price is $3.00.

Reprints are available at $.025 a page and should be ordered when manuscripts are submitted or when proofs are returned. Minimum order is 100 reprints. Either edited manuscript or proof will be returned to author for approval or correction. The author will be responsible for all corrections to proof, and must return proof preferably within 7 days.

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Department of Herpetology
Natural History Society of Maryland, Inc.
2643 North Charles Street
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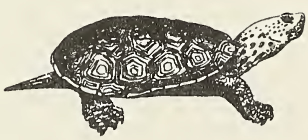
ISSN 0025-4231

DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.



MDHS........A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

DECEMBER 1974 VOLUME 10, NUMBER 4

BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

Volume 10 Number 4 December 1974

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Volume 10 Number 4 31 December 1974

The Maryland Herpetological Society

Department of Herpetology, Natural History Society of Maryland, Inc.

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Active members over 18....$10.00, under 18....$6.00, subscribing members (outside a 20 mile radius of Baltimore City)....$3.00, Foreign....$4.00.

Meetings

The third Wednesday of each month, 8:15 p.m. at the Natural History Society of Maryland (except May-August, third Saturday of each month, 8:00 a.m.). The Department of Herpetology meets informally on all other Wednesday evenings at the NHSM at 8:00 p.m.

BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 10 31 DECEMBER 1974 NUMBER 4

BOYD'S FOREST DRAGON, *Goniocephalus boydii* (MACLEAY)

The warmer areas of the Old World are the home of about three hundred species of lizards, belonging to the family *Agamidae*. The lizards are called dragon lizards or dragons because of their resemblance to our popular image of a dragon. All are characterized by a rough scalation, round pupils, movable eyelids, four well developed limbs, long tail, clearly visible eardrum (except in "earless lizards"), symmetrical shields on top of the head, acrodont dentition and reproduction by eggs. These dragon lizards are diurnal.

In the New World their niche is filled by the iguanas (family *Iguanidae*). Iguanas also occur on some islands in the Old World, e.g. in Madagascar (seven species) and in the Fiji Islands (one species). It is remarkable, that where dragons are absent, their niche is filled by the iguanidae. There is no overlapping between the two families. Many dragons are provided with crests, frills or throat sacks, which enable them to put on terrifying displays.

Fig. 1. An adult Boyd's forest dragon, *Goniocephalus boydii*. Photograph courtesy A.I.S. (Canberra).

Some of the forty or so species of the Agamid family found in Australia are migrants from northern climes. One of these species is Boyd's forest dragon (*Goniocephalus boydii*) (Fig. 1), also called Boyd's angle-headed dragon, which entered Australia from New Guinea only recently. It reaches a total length of about 50 cm (20 in.) and is found only in northern Queensland, and the rain forests of the tablelands (Fig. 2). The tail is brownish and very long, in some cases twice the length of the compressed body. There is a prominent crest on the neck and a less developed crest down the center of the back....the crests are separated from each other. The crest on the neck consists of three enlarged white spines and a number of small ones. The grey-green to yellow-green body is partially covered with small whitish spines. The pronounced gular sac (Dewlap), well developed in males, with sharp spines on the front edge, is brownish to yellowish in color. The sides of the head are decorated with large blue

patches. The lizard changes color rather readily under stress of emotion. When two males encounter they will turn pale, the bodies will show a number of dark transverse bars and the gular sacs will be inflated. After erection of the nuchal and dorsal crests the two males will approach each other, bobbing their heads up and down. This performance is mostly bluff and generally, one of the males will depart before the encounter ends in actual combat.

Fig. 2. Distribution of *Goniocephalus boydii* in Australia.

Goniocephalus boydii must be considered terrestrial rather than arboreal, in spite of the fact that it has well developed limbs with strongly clawed feet. It can climb trees, but does this only in search of food. When disturbed it remains perfectly quiet until actually picked up (Dale, 1973). Its green hue makes it almost impossible to see on moss and rubbish among trees and creepers, the natural habitat of this species. It seems to rely on its camouflage, instead of retreating at the sign of danger.

The hindlegs are extraordinary long. This appears to be an adaptation for swift running. However, this particular species of forest dragon is somewhat clumsy on the ground (Worrell, 1963). Davey (1970) assumes that the large hindlimbs were evolved by ancestors which lived in open areas.

Boyd's angle-headed dragon is not common and our knowledge of this species is scanty. It is rarely seen, probably because of its cryptic coloration. Wells (1972), who visited the Atherton Tablelands near Cairns (eastern seaboard of Queensland), claims, on the contrary, that the lizards are not uncommon in that region. They were often sighted in the rainforest.

The diet consists mainly of large insects, but also includes snails, grubs, worms, and small vertebrates such as birds. *Goniocephalus boydii* is oviparous, like all Agamid lizards, and lays 2 to 5 eggs per clutch. A gravid, dead specimen examined by Wells (1972) contained 3 eggs, the largest measuring 27 mm (1.05 in.) in length and 14 mm (0.54 in.) in diameter. The female does not always cover the clutch with soil, and sometimes just deposits the eggs on the ground. The eggs hatch after an incubation period of 3 to 4 months, depending on the warmth and moisture of the surrounding sand.

There are two other species of forest dragons (genus *Goniocephalus*) occuring in Australia. One species, the rain-forest dragon (*Goniocephalus spinipes*), which grows to about 35 cm (14 in.), inhabits the remote forests of eastern Queensland and northeastern New South Wales. It is very rare. The crest on the back of the neck and back form a single row of spines, contrary to the former species.

The other species, the great crested dragon (*Goniocephalus godeffroyi*),

is restricted to the Cape York Peninsula (northern Queensland). In Australia (Bustard, 1970) it reaches a length of about 1 m (3½ ft.). It has a pronounced crest on back of the neck and a well developed one on the back continuing on to the tail. Both species are brownish dorsally with a pattern of darker spots.

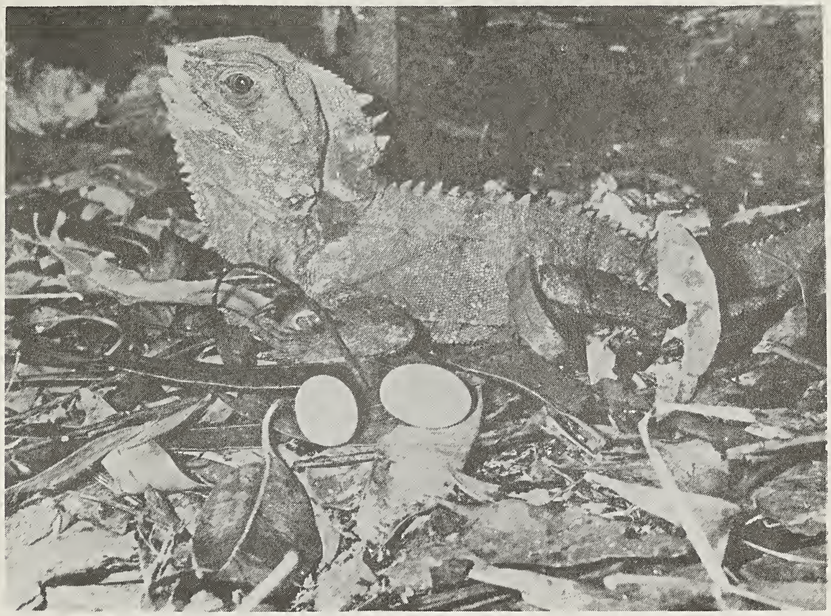

Fig. 3. *Goniocephalus boydii* with clutch. Photograph courtesy A.I.S.

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—A.J.Zwinenberg, *Borneostraat 23, Vlaardingen, The Netherlands.*

Received 4 September 1974

Accepted 8 September 1974

An Albino Ringneck Snake, *Diadophis punctatus* from New Jersey

Although albinism has previously been reported in the ringneck snake, *Diadophis punctatus* (Hensley, 1959), additional cases are of interest to record.

On 5 July 1974, Tim Marshall collected an albino ringneck snake, *Diadophis punctatus* (Fig.1) in a field on the property of Mr. Joseph T. Winner of Indian Mills, Burlington County, New Jersey. When collected, this snake was loosely coiled under a piece of tar paper.

Fig. 1. Adult male *Diadophis punctatus*.

The specimen is an adult male, measuring 190 mm in snout-vent length and 34 mm in tail length. The color in life is pinkish-white dorsally, with an orange broken ring on its neck. This ring is 2½ scales wide at its widest point. The ventral surface is orange with a large half-moon shaped pink spot, centrally located on most ventral scales. No spots are present on the caudal scales or on the chin and lower lips. The eyes and tongue are pink.

This specimen agrees in scalation and pattern with *Diadophis punctatus punctatus*, however, Conant (1958) states that the populations in southern New Jersey are intermediate between the northern and southern races.

I would like to thank Joseph E. Winner and Roy Knight for their aid in securing this specimen for me.

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—John D. Groves, *Reptile Department, Philadelphia Zoological Garden, Pennsylvania, 19104.*

Received 14 September 1974

Accepted 15 September 1974

DESCRIPTION OF A FEMALE *Micrurus diastema macdougalli* ROZE FROM PROGRESO, OAXACA, MEXICO

Roze (1967) described *Micrurus diastema macdougalli* from two male specimens (AMNH 65162, 65163) from El Modelo, Rio Chalchijapa, and Rio del Corte, Oaxaca, Mexico. Additional specimens in the collections of the University of Colorado Museum (UCM 40083-40087) from Progreso, Palomares, Juchitan, and 12 de Julio, Oaxaca, Mexico now provide further support for the subspecific designation of *M.d. macdougalli* (See Fig. 1). Three of the five specimens are females (UCM 40083, 40086, 40087), thus providing the first record of the sex for this geographic race.

Fig. 1. Dorsal views of five specimens of *Micrurus diastema macdougalli* in the collections of the University of Colorado Museum (UCM 40083-40087). Allotype (UCM 40086) top right.

DESCRIPTION OF ALLOTYPE.-In most characteristics the female allotype (UCM 40086) is similar to the holotype (AMNH 65163) and paratype (AMNH 65162). The first supralabial basis and most of the rostral are light in coloration. The black nuchal band covers the parietal tips and is interrupted ventrally. There are 18+7 black bands on the body and tail, with black tippings on the faded brick red dorsal scales. There are 222 ventrals and 39 caudals.

In *M. d. macdougalli* ventrals are fewer in males, 200-209, as compared to females, 200-225. Caudals are fewer but vary more in females, 39-47, than in males, 49-52 (Table 1). A clearer appraisal of the systematic status can only be obtained when more specimens of this distinctive geographic race become available for study.

All specimens were collected by T. C. MacDougall for whom the subspecies was named in honor of his valuable collections in the Tehuantepec region of Mexico. I am indebted to Dr. J. A. Roze, Herpetology Department, American Museum of Natural History (AMNH) for encouragement to record the University of Colorado Museum (UCM) specimens; to Dr. H.M. Smith, EPO Biology Department, University of Colorado, for editorial suggestions;

and to Dr. T. P. Maslin, Herpetology Department, University of Colorado Museum, for access to the museum's collections.

Table 1. Summary of selected morphometric and meristic characters of *M. d. macdougalli.*

MUSEUM NUMBER	LOCALITY (Oaxaca)	SEX	TOTAL LENGTH	VENTRALS	CAUDALS	TOTAL BLACK BODY RINGS (Body+Tail)
AMNH 65162	El Modelo	Male	574 mm.	200	49	23 (15+8)
AMNH 65163	El Modelo	Male	-	201	50	24 (16+8)
UCM 40084	Progreso	Male	268 mm.	208	52	32 (21+11)
UCM 40085	Progreso	Male	625 mm.	209	50	26 (17+9)
UCM 40083	Progreso	Female	229 mm.	225	47	29 (20+4)
UCM 40086	Progreso	Female	725 mm.	222	39	25 (18+7)
UCM 40087	12 de Julio	Female	225 mm.	220	40	30 (21+9)

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—Arnold Powers, *Environmental, Population, and Organismic Biology Department, University of Colorado, Boulder 80302.*

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Comments on the Feeding Behavior of Larval Tiger Salamanders, *Ambystoma tigrinum*

Except for a report of the occurrence of *Ambystoma tigrinum* in Maryland (Stine, *et.al.* 1954) nothing has been published on the biology of this salamander in the state. Here data are presented on the feeding habits of larval tiger salamanders collected on the Maryland Delmarva.

On 16-17 June 1972, 51 larval *Ambystoma tigrinum* were seined from two small ponds near Massey and Golts, Kent County, Maryland. The salamanders were preserved at the time of capture in 10% formaldehyde. The entire digestive tracts were later removed, opened, and examined for food items with the aid of a dissection microscope. Snout-vent and total lengths were measured with vernier calipers to the nearest mm.

Larvae from the two ponds differed considerably, not only in size, but also in the food items recovered (Tables 1 and 2). Therefore, we will discuss the two populations separately.

The area of the Massey pond is about one acre, varying considerably with the season. The pond is surrounded by roads and fields for half its circumference; the remainder is forested. Oaks (several species), *Quercus*; red maple, *Acer rubrum*; red gum, *Liquidambar styraciflus*; and black gum, *Nyssa sylvatica*, dominate the forest. Black willows, *Salix niger*; cattails, *Tupha latifolia*, and emergent grasses and sedges grow sporadically along the edges, but for the most part the pond is free of any dominant vegetation. Filamentous algae, an aquatic moss (*Drepanocladus*), and pondweed (*Potamogeton gramineus*) flourish in certain areas.

Forty-two *Ambystoma tigrinum*, 43-51(45.9) mm snout-vent length, 81-116(96.9) mm total length from this pond contained 1,259 food items (an average of 30.0 items per individual). In addition, almost all stomachs contained filamentous algae, which we assume to have been accidentally ingested. Identification of food items indicated that the larvae were feeding on free-swimming (i.e., Chaoboridae; Culicidae) as well as bottom-crawling and vegetation inhabiting (i.e., Isopoda, Chironomidae, Baetidae) prey. Two terrestrial insects (Homoptera and Orthoptera) were probably taken from the surface.

The Golts pond is somewhat smaller than the Massey site. It is forested on all sides, and, although most of the plants are similar to those associated with the previously described pond, the vegetation is thicker. *Riccia*, *Ricciocarpus*, *Utricularia*, *Polygonum*, *Sagittaria* and *Scirpus* were noted in this pond but were not seen at the other site.

The nine larvae from this second pond were considerably smaller (31-58(47.9) mm snout-vent length, 60-102(88.5) mm total length) than those from Massey pond. Their food items were smaller but more numerous (an average of 56.1 items per individual). They preyed more heavily on crustaceans (Tables 1 and 2) and fed mostly on free-swimming organisms. All salamanders from Golts pond contained parasitic spiruroid nematodes, family Hedruridae, *Hedrurus*, probably representing an undescribed species. A total of 31 worms were removed. Two species of *Hedrurus* are presently known from salamanders, *H. brevis* and *H. siredonis* from *Taricha torosus*.

Table 1. Food of forty-two *Ambystoma tigrinum* larvae collected 16-17 June 1972 from Massey Pond, Kent County, Maryland.

Food item	no. of items	% of items	no. of stomachs
Arthopoda			
Insecta	348	27.60	42
Coleoptera			
Dytiscidae, larvae	19	1.51	11
Dytiscidae, adult	1	.08	1
Halipidae, larvae	2	.16	1
Diptera			
Chaoboridae, larvae	46	3.65	16
Chaoboridae, pupae	10	.79	7
Chironomidae, larvae	49	3.89	17
Chironomidae, pupae	8	.63	5
Culicidae, larvae	36	2.85	8
Culicidae, pupae	6	.48	2
Ephemeroptera			
Baetidae, nymph	45	3.57	18
Hemiptera			
Corixidae, nymph	44	3.49	24
Corixidae, adult	21	1.67	14
Notonectidae, nymph	3	.24	3
Notonectidae, adult	1	.08	1
Homoptera, adult	1	.08	1
Odonata			
Aeschnidae, nymph	3	.24	3
Libellulidae, nymph	11	.87	9
Coenagrionidae, nymph	39	3.09	23
Orthoptera			
Acridadae, nymph	1	.08	1
Trichoptera			
Limnephilidae, case and larvae	2	.16	2
Crustacea	909	72.09	33
Podocopa	109	8.64	16
Cladocera	752	59.63	30
Isopoda	25	1.98	5
Amphipoda	2	.16	1
Eucopepoda	21	1.67	3
Mollusca	2	.16	2
Gastropoda	2	.16	2
Chordata	2	.16	2
Amphibia			
Acris crepitans, tadpole	2	.16	2
	1261		

Table 2. Food of nine *Ambystoma tigrinum* larvae collected 17 June 1972 from Golts Pond, Kent County, Maryland.

Food item	no. of items	% of items	no. of stomachs
Arthopoda			
Insecta	30	6.21	9
Diptera			
Chironomidae, larvae	3	.62	3
Chaoboridae, larvae	7	1.45	2
Chaoboridae, pupae	1	.21	1
Hemiptera			
Corixidae, nymph	7	1.45	4
Corixidae, adult	7	1.45	4
Notonectidae, nymph	1	.21	1
Notonectidae, adult	1	.21	1
Odonata			
Coenagreonidae, nymph	3	.62	3
Crustacea	451	93.37	9
Amphipoda	2	.41	1
Isopoda	25	5.18	5
Eucopepoda	21	4.35	3
Podocopa	403	83.44	9
Mollusca	2	.41	2
Gastropoda	2	.41	2
	483		

H. siredonis is also known from the mexican axolotl.

The size of the food items varied from 1 mm crustaceans to 17 mm *Acris* tadpoles, but there did not appear to be any correlation between the size of the larvae and the size or number of items consumed. The majority (69.9%) of the insects removed from the stomachs of these salamanders were between 6-10 mm in length. Many of the smallest items (Podocoda, Cladocera, Eucopedoda, Chrionomidae, and Culicidae) may have been consumed accidently or ingested secondarily. Dissection of Odonata larvae revealed large numbers of these smaller organisms in their gastro-intestinal tracts. The fact that *Acris* tadpoles were numerous at the time of our collection and yet represented a small percentage of prey, may indicate that little foraging is done in the shallow pond margins where *Acris* larvae abound. The tadpoles of other species of frogs known to breed in these particular ponds (i.e., *Scaphiopus holbrooki, Bufo fowleri, Hyla crucifer, H. versicolor, Pseudacris triseriata, Rana catesbeiana, R. clamitans, R. palustris,* and *R. pipiens*) were either not present or too large to have been taken as prey at the time of our collection. Stine (personal communication) observed large larval *A. tigrinum* feeding on the larvae of *A. opacum* in these ponds, but at the time of our collection, larval marbled salamanders were not present as they had probably already transformed.

In order to determine time of feeding activity, salamanders were collected at different time intervals. Collections made in the afternoon (2:00-2:15 and 3:00-3:15 p.m. DST) showed evidence of diurnal feeding. Indistinguishable material (greatly digested) varied from 10% to 30% per stomach in the afternoon sample, while those collected at night ranged from 25% to 80% indistinguishable. Nymphs of Corixidae and Coenagrionidae were found in the mouths of two salamanders from the afternoon series, further indicating diurnal feeding.

We would like to thank Peter Hertl for assistance in collecting the salamanders and Drs. D.Forrester and S.R.Telford, both of the University of Florida, for identification of the nematodes. The salamanders have been deposited in the collections of the Natural History Society of Maryland and the Florida State Museum.

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THE PARASITES OF THE RED-BACKED SALAMANDER, *Plethodon cinereus*

ABSTRACT——Of twelve *Plethodon cinereus* examined from Fairfax, Virginia, 50% were infected with the nematode *Oxyuris magnavulvaris*, with an average of 1.5 worms per host (range 1-12). Small unidentified nematodes were present in the mouth or body cavity of 25% of the hosts, with an average of 1.3 worms per host (range 1-2). Of all salamanders examined, 58.3% had nematode infections. A review of the parasites of the red-backed salamander as reported in the literature is given.

INTRODUCTION

The red-backed salamander, *Plethodon cinereus*, is the most ubiquitous salamander throughout the greater part of its range, which extends from S.Labrador and the Maritime Provinces to Minnesota; south to North Carolina and Louisiana (Conant, 1958). Terrestrial and lungless, it is confined more or less to moist wooded or forested areas, but is often found far from water bodies, occasionally even in rather dry situations. It may be found hiding beneath logs, bark, and stones; even chunks of paper or trash.

Extensive surveys of red-backed salamander stomach contents by numerous researchers have revealed largely insect remains; about 50% ants, 33% small beetles and the remainder lepidopterous larvae, Diptera and undetermined insects. Spiders and mites, sowbugs, and extraneous matter were also found. The inclusion of a mosquito larva and rat-tail maggots in the diet suggests that some *P. cinereus* had been feeding in the immediate vicinity of water or at least in very damp situations. Altogether its food consists of animals commonly found on or near the ground in terrestrial situations and is mostly limited to smaller invertebrates (Bishop, 1941).

Among different types of salamanders, the incidence and intensity of parasitic infection, and the number of parasite species present are determined by the habits and habitat preferences of the hosts which bring them in close proximity with the essential stages in the parasite life-cycle, by the degree of host-specificity exhibited by the parasite, and by the physical condition of the habitat of the salamander (Fischthal, 1951). Fischthal found, that, in general, the incidence and intensity of infection, and the number of parasite species found are greatest in the aquatic *Notophthalmus viridescens*, whereas they are least in the terrestrial *Plethodon cinereus* and *Plethodon glutinosus*; the terrestro-aquatic *Gyrinophilus porphyriticus*, *Eurycea bislineata* and *Desmognathus fuscus* maintain an intermediate position.

METHODS AND MATERIALS

Collection.--*Plethodon cinereus* were collected on 6 March, 1974, in the campus woodlands of George Mason University, Fairfax, Fairfax County, Virginia. Specimens were placed in a coffee can with moist paper toweling and stored in the refrigerator until sacrificed.

Examination of Hosts.--The salamanders were chloroformed. Tail snips and cuts at the corner of the mouth proved ineffective for obtaining blood for smears, but heart puncture provided sufficient blood for one slide, and is the only successful method reported in the literature (Rankin, 1937a). The failure of tail snip seems obvious when one considers the species practices autotomy and that any part of the tail from a point a short distance behind the vent may be broken off. Wright's stain was used; no parasitic forms were present. The body cavity was slit from the vent and cephalad lateral to the mid-ventral line. Organs were observed *in situ*, then removed to small dishes filled with saline, and examined under a dissecting microscope.

Killing and Preserving.--Only nematodes were recovered, which were fixed in hot 70% alcohol and preserved in vials with additional 70% alcohol. A phenol and absolute alcohol solution was used as a clearing agent for examining the parasites.

RESULTS AND DISCUSSION

Of twelve *Plethodon cinereus* examined, 50% were infected with the nematode *Oxyuris magnavulvaris*, with an average of 1.5 worms per host (range 1-12). Small unidentified nematodes were present in the mouth or body cavity of 25% of the hosts, with an average of 1.3 worms per host (range 1-2). Of all salamanders examined, 58.3% had nematode infections.

Listings of the parasites recovered from *Plethodon cinereus* as reported in the literature are presented in Tables 1-3. All information on the degree of parasitism reported is included. All protozoa have been included for completeness, irregardless of their being parasitic.

Protozoans (Table 1): Hazard (1937) found *Haptophyra michiganensis*, an astomatous ciliate, in a single adult specimen of *P. cinereus*. He suggests that the method of infection may be similar to that postulated for the four toed salamander, *Hemidactylium scutatum*. *Plethodon cinereus* eggs are deposited by attachment to the roof of crevices in moist logs. Bishop (1941) reported that often only a single log will be found suitable in a bit of woodland and the gravid females make their way to it in numbers. The adult female *P. cinereus* remains with the eggs until they have hatched, although, rarely both sexes may be found with eggs (Bishop, 1941). Hazard (1937) suggests that it is possible that the protozoa are voided by the female with the fecal matter and are then ingested by the young salamanders, during the time that the brood remains together. The young salamanders then carry the protozoan through maturity.

Cestodes: Few instances of tapeworm infections in salamanders have been found. Rankin (1937a) recovered *Crepidobothrium* plerocercoids from salamanders in the mountains near Durham, North Carolina. Of 74 animals studied, 8.3% were infected, with an average of 0.31 parasites per host.

Nematodes (Table 2): Rankin (1945) reported *Cosmocercoides dukae* as one of the most widely distributed nematodes in reptiles and amphibians, being found in both aquatic and terrestrial habitats. *Oswaldocruzia pipiens* is also a widely distributed nematode found in aquatic hosts, but rarely in terrestrial.

Rankin (1937a) described *Oxyuris magnavulvaris* on the basis of parasites recovered from *P. cinereus* and other species of salamanders in North Carolina. He described it "with some hesitancy"; since no males were found he encountered difficulty in placing the species in the genus *Oxyuris sensu latu* until a male could be found, and did so on the basis of what he felt were valid characters.

Table 1. Protozoa of *Plethodon cinereus*.

Parasite	#Animals Examined	% Infected	Habitat	Locality	Reference
Cryptobia borreli	--	11.5	Blood	Durham, N.C.	Rankin, 1937b
Cryptobia borreli	--	31.2	Blood	Mountains near Durham, N. C.	"
Cytamoeba bacterifera	--	7.6	Erythrocytes	Durham, N. C.	"
Cytamoeba bacterifera	--	8.3	Erythrocytes	Mountains near Durham, N.C.	"
Eutrichomastix batrachorum	--	3.4	Rectum	Durham, N. C.	"
Eutrichomastix batrachorum	--	31.2	Rectum	Mountains near Durham, N. C.	"
Haptophyra michiganensis	1	100.0	--	--	Hazard, 1937
Hexamastix batrachorum	--	12.5	Rectum	Mountains near Durham, N.C.	Rankin, 1937b
Hexamitus spp.	12	--	Large Intestine	--	Honigberg, 1953
Hexamitus batrachorum	12	--	Large Intestine	--	"
Hexamitus batrachorum	--	22.9	Rectum	Mountains near Durham, N. C.	Rankin, 1937b
Hexamitus intestinalis	--	4.1	Rectum	Mountains near Durham, N. C.	"
Karatomorpha swezi	12	--	Large Intestine	--	Honigberg, 1953
Karatomorpha swezi	--	22.9	Rectum	Mountains near Durham, N. C.	Rankin, 1937b
Monocercomonoides sp. (*M. rotunda* (Bishop)?)	12	8.0	Large Intestine	--	Honigberg, 1953
Monocercomonas batrachorum	12	66.0	Large Intestine	--	"
Octomitus sp.	12	66.0	Large Intestine	--	"
Proteromonas longifila	12	92.0	Large Intestine	--	"
Prowazekella longifilis	--	23.0	Rectum	Durham, N. C.	Rankin, 1937b
Prowazekella longifilis	--	60.4	Rectum	Mountains near Durham, N. C.	"
Trimitus parvus	12	--	Large Intestine	--	Honigberg, 1953
Tritrichomonas augusta	12	--	Large Intestine	--	"
Tritrichomonas augusta	--	96.1	Rectum	Durham, N. C.	Rankin, 1937b
Tritrichomonas augusta	--	62.5	Rectum	Mountains near Durham, N. C.	"
Tritrichomonas batrachorum	12	--	Large Intestine	--	Honigberg, 1953

In the course of examination of reptiles and amphibians, Chitwood (1933) recovered nematodes from the intestine of *P. cinereus* from Black

Pond, Virginia, which he reported as not belonging to any of the recognized groups of vertebrate parasites, but appearing definitely to be more closely related to those groups generally referred to as "free-living." He subsequently named these nematodes *Angiostoma plethodontis*.

Table 2. Nematoda of Plethodon cinereus.

Parasite	#Animals Examined	% Infected	Avg. # Per Host	Habitat	Locality	Reference
Angiostoma plethodontis	--	--	--	Intestine	Black Pond, Va.	Chitwood, 1933
Cosmocercoides dukae	--	3.4	0.19	Rectum	Durham, N.C.	Rankin, 1937b
Cosmocercoides dukae	35	8.0	--	Hindgut	Western Mass.	Rankin, 1945
Oswaldocruzia pipiens	35	3.0	--	Foregut	Western Mass.	"
Oxyuris magnavulvaris	--	2.08	0.02	Rectum	Mountains near Durham, N.C.	Rankin, 1937a,b
Oxyuris magnavulvaris	12	50.0	1.5	Rectum	Fairfax,Va.	This paper

Trematodes (Table 3): Stafford (1900, 1903) described *Brachycoelium hospitale* from Canadian salamanders *Notophthalmus viridescens* and *Plethodon erythronotus* (= *P. cinereus*) (Byrd, 1937). Rankin (1938) reviewed the genus *Brachycoelium*, reducing all known species to synonyms of *B. salamandrae* which is worldwide in distribution, and one of the commonest amphibian trematodes encountered. Rankin (1945) found a correlation between occurrence of this fluke and the habitat of the host. In the aquatic *Notophthalmus* he found only 15% infection with few worms per host observed; however, terrestrial salamanders were heavily infected (25-100%). When large numbers of flukes were present, most were quite small; conversely, when few (below 20) were present, worms were usually much larger in size.

Table 3. Trematoda of Plethodon cinereus.

Parasite	#Animals Examined	% Infected	Avg. # Per Host	Habitat	Locality	Reference
Brachycoelium hospitale	--	3.4	0.03	Intestine	Durham, N.C.	Rankin, 1937b
Brachycoelium hospitale	--	47.9	2.14	Intestine	Mountains near Durham, N.C.	"
Brachycoelium salamandrae	--	--	--	--	Linville, N.C.	Rankin, 1938
Brachycoelium salamandrae	35	25.0	--	Intestine	Western Mass.	Rankin, 1945
Brachycoelium salamandrae	36	2.8	3.00	Small Intestine	South-central New York	Fischthal, 1955a
Brachycoelium salamandrae	24	20.8	3.20	Small Intestine	State Forest Park, Pa.	Fischthal, 1955b
Brachycoelium louisianai	--	--	--	--	--	Walton, 1962
Brachycoelium obesum	--	--	--	--	--	"
Brachycoelium obesum	--	--	--	--	Giles, Charlottesville, and Albamarle Counties, Va. and Chester Co.,Pa.	Cheng, 1960
Brachycoelium storeriae	--	--	--	--	--	Walton, 1962
Brachycoelium storeriae	4	100.0	1.00	--	Bucks Co.,Pa	Cheng and Chase, 1961

Fischthal (1955a) found that of 503 salamanders studied (including 36 *P. cinereus*) *B. salamandrae* was found in more hosts than any other parasite. He observed that in south-central New York terrestrial *Plethodon glutinosus* appeared to be the most important host of this worm possibly because a terrestrial invertebrate serves as intermediate host. He also observed crowding in the host's intestine caused them to be smaller in size at sexual maturity. Cheng (1960) initiated a study to determine consistent characteristics by which the *Brachycoelium* species could be distinguished from one another. By studying more than 350 adult worms, recovered from the small intestine of *P. glutinosus* and *P. cinereus* captured in Virginia and Pennsylvania, he determined that *B. obesum* can be separated from the others particularly by its large cirrus pouch which is approximately twice the diameter of the acetabulum in length. He concluded that in view of the information contributed by the life history of *B. obesum*, it seemed logical to consider the Brachycoellidae, the Plagiorchiidae, and Dicrocoellidae as independent families subordinate to the superfamily Plagiorchioidea Dollfus, 1930. Cheng and Chase (1961) recognized eleven species in the genus *Brachycoelium*. Walton (1962) further suggested resolving the systematic status of *Brachycoelium* by knowledge of the life history patterns.

An experminental infection of *P. cinereus* with *Microphallus opacus* was reported by Rausch (1947). Metacercarial cysts collected from naturally infected crayfish collected in central Ohio were administered by stomach tube to salamanders collected from an area in Southern Michigan where *M. opacus* is absent. Of three salamanders, one contained 36 immature trematodes when examined, and one voided 7 immature living trematodes on the third day.

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GROWTH RATE OF *Lichanura r. roseofusca* IN CAPTIVITY

Kurfess (1967) records growth rates on captive juvenile *Lichanura r. roseofusca* over 9 months and presents data for an adult female for one year in captivity but provides no data on aspects of maturation in the juveniles other than length increase.

Kurfess (1967) indicated a very rapid growth rate for *Lichanura* based on a brood of captive born young. In this brood of 5 young the average length at birth was 35.18 cm. After 9 months the length averaged 74.04 cm. Another snake held captive by Kurfess, however, did not show this rapid growth. This snake, 35.65 cm long at capture, grew to 45.72 cm in 1 year. During the second year it grew an additional 18.68 cm and successfully inseminated a female of the species indicating that it was sexually mature.

Although a *Lichanura r. roseofusca* lived 12 years in captivity (Perkins, 1953) long term growth records are unavailable. Kurfess' data which primarily reveal growth rates of young snakes for short periods should be reviewed concurrently with the following records to provide a more complete picture of growth of *Lichanura r. roseofusca* from hatching to adulthood.

PROCEDURE

A snake was captured 5.5 mi. SE of Escondido, San Diego County, California, in a boulder-chapparal association at 10:30 a.m. on 7 September 1968. It was basking in an open area approximately 500 yards from a small reservoir.

Weight measurements were taken on the first of each month with an Ohaus triple beam balance. Food was withheld for one week prior to all weighings.

Length was calculated as the average of ten measurements and was rounded off to the nearest whole centimeter. All feedings were recorded for the entire period except for a 2 month period in 1972. Defecation dates were recorded and the interval since the last feeding determined. Shedding dates were noted and the interval since last shedding recorded. Since shedding may act as an index of growth rate the number of sheddings per year and the interval between sheddings is of interest.

RESULTS AND DISCUSSION

The snake was 77 cm long at the time of capture. Kurfess' (1967) records of a successful mating of a male *Lichanura r. roseofusca* when 64.40 cm in length indicate that this snake was near maturity at the time of capture.

TABLE 1 summarizes the data and reveals several trends. First, length increases per year became progressively smaller as the snake aged. Growth was relatively constant at 2 cm per year during the last 2 years. Kurfess reported a length increase of 2.5 cm for an adult female during 1 year in captivity and it appears that 2-3 cm per year is a relatively steady growth rate even for old *Lichanura r. roseofusca*.

TABLE 1

SUMMARY OF DATA FOR GROWTH RATE OF *LICHANURA R. ROSEOFUSCA*

Year	No. Mice Eaten	Interval from Feeding to Defecation (days)	No. Shed.	Interval Between Shed.	Body Wt.* Gms.	Wt. Gain For Year Gms.	Length (cm)	Length Increase For Year (cm)
1968	12	4.0			311		77	
1969	44	4.3	6	61.2	313	2	79	2
1970	45	5.6	4	90.3	329	16	80	1
1971	43	5.5	4	88.0	355	26	84	4
1972+	33	5.8	3	93.0	374	19	87	3
1973	40	5.7	3	131.7	395	21	89	2
1974++	10	5.8	0		405	10	91	2

*Weight for January of the given year except October of 1968.
+Records of feedings are not available from February to April of 1972.
++All data for 1974 are as of April 1.

Second, the number of sheddings per year decreased with age and diminishing length increase rates. This observation supports a hypothesis that shedding takes place in response to the need for a more spacious integument which is not obtainable by other means. The frequency of shedding is apparently little affected by the amount of weight gained. To wit, the snake shed 6 times in 1969 and gained 16 grams while in 1971 it shed only 4 times but gained 26 grams. Possibly, shedding is a response to length increase alone, a larger weight gain may be necessary to induce shedding, or shedding may be a response to internal, physiological conditions not specifically related to growth.

As the snake aged, the mean time from feeding to defacation increased from 4 days in 1968 to 5.8 days in 1974. This increase may indicate a reduction in the general metabolic rate which accompanies aging.

Although such functions as shedding, defacation, and linear growth show distinct patterns, it is interesting to note that weight gain seems to follow no predictable pattern. Weight gain in 1971 was 31% higher than during 1969 but weight gain in 1973 was 52% lower than during 1969 although the snake was eating regularly since its initial capture.

SUMMARY

1. Although young have been reported to grow much faster, (Kurfess, 1967) adult *Lichanura r. roseofusca* grow at only 2-4 cm per year with growth rate becoming slower as the snake ages.

2. Mean time between feeding and defecation increased as the snake aged, possibly indicating a general metabolic slow down in advanced age.

3. Frequency of shedding decreased with age and showed little correlation to weight gain; apparently induced

primarily by length increases or internal, physiological factors.

4. Weight gain for *Lichanura r. roseofusca* showed no relationship to age but seemed to be governed by other factors in mature individuals.

ACKNOWLEDGEMENTS - I would like to express my gratitude to Dr. B.H. Banta for providing the impetus behind the writing of this paper and for his suggestions and criticisms in the preparation of the manuscript.

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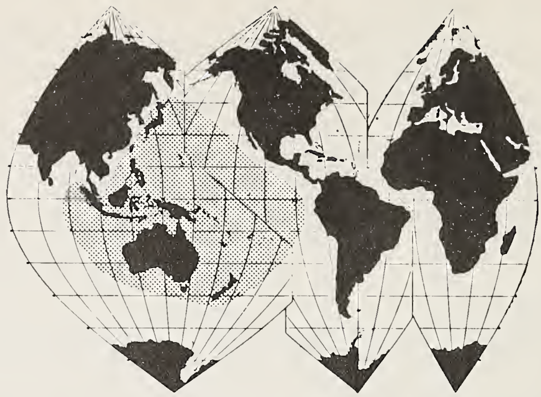
NEWS & NOTES



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DEPARTMENT OF HERPETOLOGY

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MARCH 1975

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Bulletin of the Maryland Herpetological Society

Volume 11 31 March 1975 Number 1

An Endangered Species, The New Mexican Ridge-Nosed Rattlesnake

Herbert S. Harris, Jr. and Robert S. Simmons

In the southwestern corner of the state of New Mexico, lies a range called the Animas Mountains, or as the name Animas implies, "Spirit Mountains". In this range, in rough and almost inaccessible habitat, is found a small and unique rattlesnake, the New Mexican ridge-nosed rattlesnake. This species is seriously threatened with extinction from over-zealous collectors and the potential use of its habitat for man's endeavors.

Before we discuss this population we would like to review the entire ridge-nosed rattlesnake (*Crotalus willardi*) complex, discussing its evolutionary history and present problems. The name "ridge-nosed" is derived from, as the name implies, a ridge running along the upper edge of the snout. This group of snakes is unique in having such a pronounced ridge and hence has acquired the common name of ridge-nosed rattlesnake. These snakes are small, usually less than two feet in length. The ridge-nosed rattlesnake is a retiring species that usually lies undetected in the leaf litter of their pine-oak woodland habitat. Their relatively weak venom makes them no threat to man; no fatalities have ever been reported from their bite. Therefore, the protection of such an inoffensive species, even though it is venomous, will constitute no threat to man.

It is our opinion that the ridge-nosed rattlesnake evolved from tropical ancestors along with the plant communities known as the Madro-Tertiary Geoflora and that this biotic community reached its distributional peak by the Mid-Miocene. Fragmentation of various populations began as arid habitats interrupted this biotic community during the Pliocene, less than five million years ago, and continued into the Pleistocene as the American deserts were formed. These populations may have been isolated and reconnected many times during the various periods of both the Pliocene and Pleistocene with the reconnecting of populations occurring during the pluvial periods. These events eventually restricted the ridge-nosed rattlesnake to the pine-oak woodland biotic communities above 5,000 feet elevation. Eventually this mountaintop isolation resulted in the evolution of the five subspecies currently known and recognized today.

The southern ridge-nosed rattlesnake, *Crotalus willardi meridionalis* has the most primitive characters and is found in the Sierra Madre of southern Durango and northwestern Zacatecas in Mexico. Next in primitive characters is the del Nido ridge-nosed rattlesnake, *Crotalus willardi amabilis* which is found in small disjunct habitats in the Sierra del Nido, which lies east of the Sierra Madre in Chihuahua, Mexico. These are followed by the west Chihuahua ridge-nosed rattlesnake, *Crotalus willardi silus*, which appears to have been the most successful of the group, occupying the largest distribution, and occurs in the Sierra Madre Occidental of western

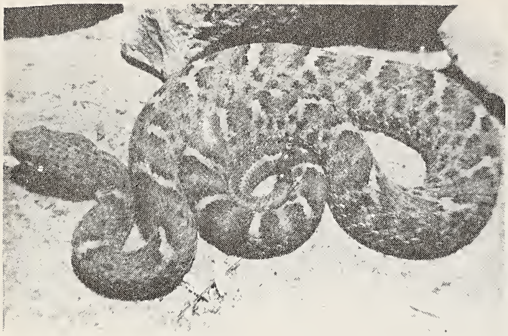

Fig. 1. The New Mexican ridge-nosed rattlesnake, *Crotalus willardi ssp.* Photograph by Dr. Robert S. Simmons

Fig. 2. The Arizona ridge-nosed rattlesnake, *Crotalus willardi willardi* Photograph by Dr. Robert S. Simmons

Chihuahua and eastern Sonora along the Continental Divide in Mexico. The New Mexican ridge-nosed rattlesnake, *Crotalus willardi ssp.*, and the Arizona ridge-nosed rattlesnake, *Crotalus willardi willardi*, both occupy smaller disjunct habitats. The New Mexican rattlesnake's range, as previously stated, includes the southwestern corner of New Mexico in the United States. The Arizona ridge-nosed rattlesnake is found only in the Santa Rita and Huachuca Mountains of southeastern Arizona and the adjacent ranges in Sonora, Mexico.

The relatively large number of subspecies of *Crotalus willardi* recognized today indicates a species with a long history of isolation between populations. The gene flow between some of these populations has been interrupted at different times during past geologic history, which is reflected in the subspeciation existing today. These isolated populations, in being restricted to the pine-oak woodland biotic communities with adverse habitat between them, are similar to island species. Below pine-oak woodland is encinal and then open grassland, which are in part responsible for the restrictions of *Crotalus willardi*. The knowledge we gain in our studies of the evolution and differentiation of these populations of *Crotalus willardi* may help shed some light on the climatologic and geologic processes in the evolution of the deserts of western North America. These studies along with geologic and paleobotanical data may yield additional insight in the past geologic history of our continent.

All of the populations of ridge-nosed rattlesnakes are endangered to some extent but some are in immediate danger of extinction if protective measures are not taken immediately. The southern ridge-nosed rattlesnake, *Crotalus willardi meridionalis*, and the del Nido ridge-nosed rattlesnake, *Crotalus willardi amabilis* may be in imminent danger. Both occupy small ranges and are losing habitat. The del Nido ridge-nosed rattlesnake's habitat is disjunct and it would not take much damage to its habitat for this snake to become extinct as at present it is only known to inhabit two canyons. The southern ridge-nosed rattlesnake occupies a larger range which includes some inaccessible habitat and is slightly safer for the moment.

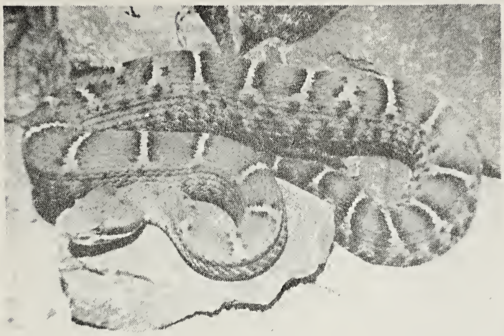

Fig. 3. The west Chihuahua ridge-nosed rattlesnake, *Crotalus willardi silus.*
Photograph by Dr. Robert S. Simmons

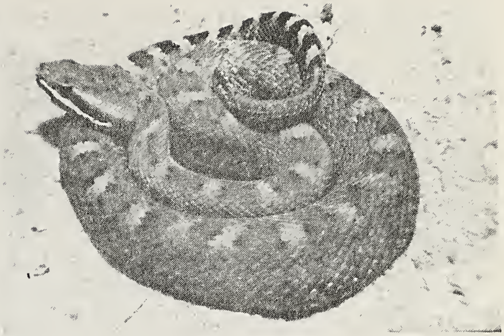

Fig. 4. The southern ridge-nosed rattlesnake, *Crotalus willardi meridionalis.*
Photograph by Dr. Robert S. Simmons

The west Chihuahua ridge-nosed rattlesnake, *Crotalus willardi silus*, is widespread in northern Mexico (Sierra Madre Occidental) and is not threatened with extinction *per se*. Habitat alteration is the most serious threat to this species at this point in time. Lumbering and cattle grazing are probably taking their toll. Many of the ridge-nosed rattlesnake's habitats in northern Mexico have been partly cleared of pine trees. This practice, if not carried to extremes, may not be disastrous; and if present data are correct, it may even be beneficial in some rare cases. In a few areas in Mexico, where some clearing has been done, lizard populations, the food source of many montane populations of rattlesnakes, appear to have increased. Of course, with most of the trees gone, the snakes would probably have to change their habits somewhat if they were to survive.

It is conceivable that parts of various forest habitats have been partly cleared by fire in the past, and that these areas appear to have been eventually biologically restocked; a process called succession. This biological restocking, of course, implies that in the case of habitats that

Fig. 5. The del Nido ridge-nosed rattlesnake, *Crotalus willardi amabilis.*
Photograph by Ed Cassano

Fig. 6. View of Animas Peak from the entrance of one canyon.
Photograph by Herbert S. Harris, Jr.

are restricted, all of the restricted species were not totally eradicated. In pine-oak woodland, with little underbrush, and well-spaced trees, fires generally burn fast, in many cases doing little damage. Pine cones burst in fire, spewing seeds to start a new forest. In cases where fires or other factors denude a range, some species of vegetation (can be carried by birds, insects and wind) and the more active mammals may be able to cross inhospitable areas with little difficulty. When an area is cleared, either by natural causes or by man and his activities, only time can restore the area back, hopefully, to its original condition.

There are ranges off the Sierra Madre proper that should contain *Crotalus willardi*, but apparently do not. Perhaps these disjunct ranges were destroyed by fire or some other cause, and only some plants and the more active animal species were able to recolonize. It is also possible that disease, predators, or other factors could have exterminated the ridge-nosed rattlesnakes from these habitats. We must protect what we know exists, as every population is important, and once it is lost it cannot be restored.

There are important isolated populations of the west Chihuaha ridge-nosed rattlesnake that are in imminent danger of having their habitats destroyed either by man's misuse of the land or by natural causes. On some of these ranges, the habitat is already so limited as to make extinction a day to day concern. These populations are those located on the mountain ranges lying west and northwest of the Sierra Madre proper. It is on these disjunct ranges surrounded by grassland that total habitat destruction would take its toll, leaving the animals no place to retreat. This is perhaps the greatest concern with all the disjunct *Crotalus willardi* populations.

Passing over the New Mexican ridge-nosed rattlesnake for just a moment, the Arizona ridge-nosed rattlesnake, *Crotalus willardi willardi* is effectively protected in Arizona along with two other montane species of rattlesnakes, the western twin-spotted rattlesnake *Crotalus pricei pricei*, and the banded rock rattlesnake, *Crotalus lepidus klauberi* under Arizona's Endangered Species Law, which was passed in 1969. The Arizona ridge-nosed rattlesnake is also listed in the "status undetermined" category by the United States Department of the Interior on their official list of *Threatened Wildlife of the United States* (1973 edition). Destruction of habitat through man's use of the land for development is still a serious threat to this subspecies though. In addition to the two ranges in southern Arizona there are three mountains in northern Mexico just across the international boundary that harbor snakes that appear to be intermediate in most characters between the Arizona ridge-nosed and west Chihuahua ridge-nosed rattlesnakes. These areas are extremely important if we are to understand relationships, but are also being destroyed by man's misuse of the land.

The New Mexican ridge-nosed rattlesnake was first collected in the Animas Mountains in 1957 and was for many years thought to be just an extension of the range of the west Chihuahua ridge-nosed rattlesnake. The authors discovered its distinctiveness and are currently describing this population as a new subspecies. It is probably the most distinctive of all the *Crotalus willardi* subspecies, being grayish-brown instead of the richer browns of the other subspecies. It also lacks all of the characteristic white flash-marks of the head, which are so obvious in the other subspecies, and which is the most diagnostic character. This snake is known from only two canyons in the Animas Mountains, which are less than

two miles from each other and from one canyon in the Sierra de San Luis, which lies in the Mexican State of Chihuahua just across the international boundary. It might be mentioned that in the Sierra de San Luis, and in one of the canyons in the Animas, only one specimen is known from each area.

Up to this point, we have only mentioned the threats to these snakes from habitat loss and nothing about the loss from snake collecting.

Due to the natural beauty and uniqueness of the ridge-nosed rattlesnake, it is actively sought after for the pet and zoo trades. Arizona's Endangered Species Law has effectively protected its populations, and the Mexican populations of the ridge-nosed rattlesnakes are relatively safe from collectors, too, inasmuch as the Mexican government requires permits to collect any animal in its country and these permits are becoming increasingly harder to get. Specimens are still being smuggled out of Sonora, Mexico, but this will stop with the recent enforcement in the United States of the Lacey Act.

In 1972, the state of New Mexico tried to pass legislation to protect its populations of the ridge-nosed rattlesnakes and other non-game species of wildlife but was unsuccessful. A similar bill in 1973 also failed. Thus the New Mexican ridge-nosed rattlesnake with its extremely limited distribution is one of the most vulnerable subspecies of the ridge-nosed rattlesnakes and the only unprotected subspecies!

The U.S. Department of the Interior is gravely concerned about the fate of this unique population and is currently evaluating the need to list this subspecies on its official list of endangered native fish and wildlife. They have also contacted Mr. Peter G. Wray of the Pruett-Wray Cattle Company, the owner of the Animas Mountains, and he has offered his full cooperation in every effort to preserve this unique habitat and its inhabitants. Access to the canyons and ridges of the Animas Mountains for any purpose that could be detrimental to the rattlesnake is prohibited for the time being.

With five subspecies known, some collectors and zoo-people feel that if possible five should be represented in their collections. Due to the inaccessibility of its habitat and the snakes natural beauty, the price is high for such a trophy which attracts many unscrupulous collectors and dealers. Since permits are required in Arizona and Mexico, New Mexico suffers the brunt of collecting. Animal species with highly specific habitat requirements in marginal areas can be easily exterminated by collectors. The local pockets of distribution may seem to be densely populated, but they cannot long withstand intense collecting. With such localized populations, every individual is important for maintaining the genetic diversity of the species, as the removal of any specimens can constitute a serious drain on these populations.

The habitat destruction that usually accompanies unscrupulous collectors must be seen to be believed. Rock turning and log rolling are minor when compared to the use of crow-bars in destroying rock outcroppings. Another technique which was recently mentioned to us, incidentally, while visiting the Animas Mountains, was the use of gasoline. We understand that some of the limited habitat of the already seriously threatened del Nido ridge-nosed rattlesnake were saturated with this volatile and deadly liquid to force the snakes out from under cover. Unfortunately, many more can be killed than collected with this technique.

Fig. 7. View of the habitat of the New Mexican ridge-nosed rattlesnake. Photograph by Dr. H. W. Campbell

Fig. 8. The tell-tale evidence of snake collectors. Photograph by Dr. H. W. Campbell

While doing research on the New Mexican ridge-nosed rattlesnake in the Animas Mountains last August, Herbert Harris, Jr., encountered 15 collectors from six states trying to collect specimens of this snake. We are thankful that we successfully have this land posted and protected at least for the time being, as few habitats or species can long withstand such irresponsible overexploitation.

The New Mexican ridge-nosed rattlesnake faces still another danger through man's development. Land in the Playas Valley, along the east slope of the Animas Mountains, has been purchased and plans are underway for the construction of a copper ore reduction plant. The first buildings are already going up. A "company town" for 1000 families is also planned. The impact on the New Mexican ridge-nosed rattlesnake will be disastrous. Stack emissions of sulfur dioxide (SO_2) could pose a serious problem. Technology is not yet available or would be too costly to clean up the emissions from a plant of the sort proposed. The human impact on these mountains is of greater concern. The development here may not always be restricted to the valley and it is conceivable that hunting, off road vehicles, and possibly recreational activities will pose serious threats for the Animas Mountains and its inhabitants in the near future.

In order to assure the survival of this extremely unique resource we cannot rely on the efforts of the owner of this property, but must insist that the federal government does everything possible to insure its survival without question. This can hopefully be accomplished through its listing as a Federal Endangered Species. In this way, the habitat and its inhabitants will get the full attention they deserve. The New Mexican population and the population in the Sierra de San Luis are in dire need of protection, and this protection must be imminent!

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Editor's Note:

"An Endangered Species, the New Mexican Ridge-nosed Rattlesnake" was written for the *NRA Conservation Yearbook, 1974*. Due to the simularity with a previous popular article that appeared elsewhere it was not used. Although, this is a popular article, it is being published here as it contains information that should be said.

H.S.H.

SAVE THE RIDGE-NOSED RATTLESNAKE

By writing the Office of Endangered Species, and urging them to list the New Mexican ridge-nosed rattlesnake as an endangered species you can aid in the protection of a truly unique species. Write today...

Director
Bureau of Sport Fisheries and Wildlife
U.S.Department of the Interior
Washington, D.C. 20240

A Case for Field Notes from Life

Living as most of us do in a country whose herpetofauna is relatively well known, some of the habits deliberately inculcated as a matter of routine a few decades ago in young disciples of established herpetologists now may seem futile anachronisms. In earlier years, when even in this country the herpetofauna was sketchily known, it took no argument to convince a neophyte that every opportunity to observe habits and colors in life was precious and worthy of written record in painstaking field notes. Now all seems "old hat," for apparently everyone knows all except the rarest species in exhaustive detail. There remains little, readily accessible incentive to record with meticulous care what everyone already knows and is in print in a dozen places or for developing a habit of making such records, and most established herpetologists have given up all effort to develop such incentive among their students, since even their own habit of keeping regular field notes has generally been sacrificed to other, more rewarding endeavors.

Minimization or total neglect of field records is a lamentable mistake - not a matter of nostalgia, but because the baby has been thrown out with the bath. It cannot and should not be denied that many field observations are now repetitive and do not merit reiteration, at least in print. It behooves a field worker to acquire a realistic perspective in which to view the effort to make copious field notes. That perspective will take into account at least four considerations, as follows:

1. The value of writing practice. Writing remains the chief means of communication in the world of science, despite the burgeoning of television and growing popularity of societal meetings. The general level of proficiency in writing has, however, gravely deteriorated, largely because of a rapidly increasing preoccupation with audiovisual communication. Writing skill requires practice, for which progressively less time is being allotted. The benefit of regular note-taking in providing such practice is sufficient by itself to justify the habit. Facility, economy and accuracy of expression are perforce developed even with no more criticism than the writer himself can provide, for comparison with the printed and spoken word is inevitable if the writer does the normal amount of reading and listening. Skill is developed more rapidly with criticisms, suggestions and comments of others, but they are not vital.

2. Improvement of the skill of observation. Indeed, the exercise of note-taking not only improves writing skill per se, but also sharpens the ability to observe. The need for something to write about requires attention to details that otherwise would not be noticed. Practice in observation is just as vital as practice in writing, and each benefits greatly from the other. There are no shortcuts to expertise of observation and expression; some individuals, more than others, find the route to expertise a bit easier, or a bit more satisying, but in every case practice in large amounts is required to develop skill. Even famous writers must spend interminable hours achieving their skills. Explicit will and

effort are essential, for both the gifted and the ordinary and the difference between them lies mostly in motivation, not in innate ability.

3. Animal behavior and characteristics remain extensively unknown. Although the basic facts of identity, distribution and characteristics approach reasonable completeness for most species living in the United States, our ignorance of behavior and demography is tremendous. The complexities of human behavior, which still taxes the best minds and continually produces surprises, are at least matched and in some cases perhaps exceeded among other species of animals. Actions are responses to stimuli, but what those stimuli are and how they are received and evaluated is extensively unknown. Even the action patterns themselves are sketchily recorded in most cases.

An excellent case in point is the yet incomprehensible homing ability of many animals, conspicuously birds. Clearly there are responses to a galaxy of stimuli as yet scarcely understood, for which receptors are completely enigmatic, and dependence upon which is clearly adaptable to circumstance: if one set of criteria ordinarily available is blocked, there are alternative sets of criteria that can substitute.

In these areas, of behavior and population structure, field observations can contribute importantly to present knowledge, even for common species anywhere. An open mind diligently applied can contribute significant observations anywhere that animals live.

Yet even the more basic knowledge of characteristics of structure and color is surprisingly deficient for many species even in this well-surveyed country. It is the ephemeral qualities that are least appreciated, obviously, such as color and even pattern, for herpetologists are cursed with the fact that once his animal is dead and/or preserved, the colors are no longer true to life. Only by detailed description from life, or by color photography, can colors be recorded for posterity. It is surprising how many species of the United States remain incompletely known in these respects, providing extensive opportunities for clarification through field notes. For example, it is just now becoming apparent that the most common frog of this country and Mexico, *Rana pipiens*, actually is a complex of a dozen or more species and subspecies, with largely complementary geographic ranges. What isolating mechanisms at points of contact or overlap preserve the integrity of the different species? What behavioral mechanisms or physiological preferences distinguish them? Field observations are required to provide answers.

4. Exotic opportunities. Whatever the opportunities in our own country, they are multiplied many times in tropical areas where virtually all species are poorly known and the herpetofauna may be much more varied. It is a source of keen dismay that, for example, so many workers have explored and sampled parts of Mexico with such limited perspectives, seeking some specific species, or randomly collecting everything within reach, little aware of the goldmines of information they pass by in their haste or narrow interests. Far more consistently useful contributions can be made by selection of a favorable site and observing and recording colors, patterns and behavior of relatively easily accessible species and of individuals of less common species as encountered by chance - all from life. Those who by nature or circumstance must keep on the move at least can

take the time and trouble to record colors in life. None of these useful endeavors require preservation of specimens, which can be observed extensively without capture, or if captured can (and should) be released as near as possible where caught. Thus the expense and red tape of collecting permits, increasingly a hurdle everywhere, can be avoided. Occasionally it will be necessary to preserve samples for identification purposes, but as expounded several years ago by one of the ablest and most active of American herpetologists (W. E. Duellman), the time has passed for miscellaneous collecting and for reports upon miscellaneous collections, certainly for the United States, and also for most other areas of the globe. This is the first and perhaps easiest sort of exploration for new information that can be pursued in relatively unknown regions, for the collector can concentrate narrowly on collecting and reserve for the laboratory the tedious and time-consuming study of the fruits of his labors. In this way his time is used with maximum efficiency as he extracts everything possible from the rare opportunities to be in the field, and not taking time in the field for activities that can be performed in the lab.

As this phase of productivity is passed, however, it must be realized that the alternative is not merely, then, a search for special rarities, but to capitalize upon field opportunities for observations in life. This may seem unproductive, at first, for it lacks some of the glamour and excitement of discoveries of rarities or new taxa, but it has a permanent value equally as great, and it furthermore cannot be conducted in the laboratory, at least with equal validity. Under these circumstances field notes, recorded on the spot, are vital, for memory cannot be trusted with such ephemeral detail.

Although a number of models for such field contributions exist, notable examples include several works of P. J. Kennedy, Jr. (*e.g.*, 1965a, 1965b, 1968), and one by Maslin (1963). The latter brings to mind the tragic lack of color notes from life for various species of *Sceloporus*, specifically *S. serrifer*. For many years it has been supposed that the several taxa now associated with that species (see Stuart, 1970) are all of the brown-red-gray ground color characteristic of most species of the *torquatus* group; Stuart did not, therefore, use color as a character in his monograph. Specimens certainly appear brownish in preservatives, and most workers have carried out their critical studies on preserved material even though they may have collected many specimens. *S. serrifer serrifer* was redescribed by Smith (1938:560) as "uniform olive or brownish olive" dorsally, behind the collar, in both sexes, and the description of *S. serrifer plioporus* (Smith, 1939:212) added nothing to the color account. Even *S.s.prezygus* was originally described (Smith, 1942:355) as "yellowish gray" dorsally, posterior to the collar.

Then evidence began slowly accumulating that all is not as it had seemed relative to the colors of *serrifer* in life. First Martin (1952:4) commented that the dorsal ground color in *S. serrifer cariniceps* "varies from pale dusky tan to metallic bluish green" - a rather disturbing statement at the time, but it seemed perhaps attributable to anomalous individual variation. Then Axtell (1960:236) quite explicitly described *S. serrifer prezygus* as "bright greenish-blue in males, dull brown mottled with black or dark brown in females." At this point it seemed likely that only *S. s. prezygus* is greenish blue in males. Later Maslin (1963:12) stated that

in *S. serrifer serrifer* "The more posteriorly located dorsal scales and especially the scales of the tail are marked with blue," and "The dorsal pattern of the trunk region in males is virtually non-existent."

Finally, this year my friend Tom Stubbs commented that in the Los Tuxtlas volcanos area of southern Veracruz, as both he and Douglas Robinson (who lived there several years) had personally observed, there lives a large, green or green-blue *Sceloporus* high on large trees. Actually a bright green color is generally diagnostic of members of the *formosus* group of *Sceloporus*, none of which are known from the Tuxtlas volcanos, although *S. formosus* itself occurs on the escarpment of the Mexican plateau about 100 km to the southwest. Two of my local colleagues, Drs. Alex Cruz and Yan Linhart, upon urgent appeal to obtain a sample of this lizard when they recently visited the volcanos, observed one or more specimens, all bright greenish-blue or bluish-green. It remained for a friend of theirs, Dr. Robert L. Jeanne, specializing in myrmecology, to obtain a specimen. Upon arrival in preservative, it proved to be the typical brownish olive, but Dr. Jeanne assures me that in life it was bright green, with some blue about the head, and the tail less brightly colored.

It now appears, at long last, that adult males of all populations of *S. serrifer* are bluish and/or greenish. It seems likely that *S. s. serrifer* is less brightly colored than the other subspecies. The enigmatic southern Veracruz population, originally named *plioporus* but later (Stuart, 1970) regarded as intermediate between *cariniceps* and *s. serrifer*, was referred to *s. serrifer* by him, whereas the color suggests that it may be referable to *S. s. cariniceps* (which it antedates). Further observations in life will be required to settle these problems and to establish the validity of these generalities.

But the role of color in life in deducing relationships of these members of *Sceloporus* carries still further. *S. cyanogenys*, a large species of southern Texas and adjacent Mexico, is typified by males of a bright greenish blue as described first by Taylor (1931) in an excellent detailed account. This species was long thought to be related most closely to *Sceloporus torquatus*, which indeed does occur in Nuevo Leon close to the range limits of *S. cyanogenys*; intergradation long remained a possibility that could be dealt with only by exploration of intervening territories. Recent work has demonstrated sympatry of indeed two subspecies of *S. torquatus* with *S. cyanogenys*, at least eliminating considerations of conspecificity. The problem of relationship remains, however, but color in life of adult males promises to lead to definitive solutions. *S. torquatus* males are, as in most other species of the group, variants of the brown-red-olive type, never greenish or bluish. The species is, furthermore, restricted to the central plateau of Mexico, whereas *S. cyanogenys* is essentially a lowland species, invading higher altitudes only at the peripheries of its range.

Since *S. serrifer* runs to the same blue-green colors as *S. cyanogenys*, and is likewise largely limited to lowland areas, it seems far more likely that it rather than *S. torquatus* is the closest relative of *S. cyanogenys*; the two form a continuous chain of blue-green *Sceloporus* around the western margin of the Gulf of Mexico, although it is as yet unknown whether their ranges overlap or are separated in central Tamaulipas, or whether they

intergrade. Intergradation now seems unlikely because of marked structural differences between the two, but stranger conspecifics have been documented.

The occurrence of a blue-green subdivision in the *torquatus* group suggests also that it may constitute a link between the *torquatus* and *formosus* groups, the latter consisting almost wholly of blue-green species, most of which have some evidence of a black dorsal collar about the neck, although never light-bordered as is characteristic of members of the *torquatus* group. All members of both groups are likewise viviparous.

Since the *formosus* group also contains species (*lunaei, acanthinus, tanneri, stejnegeri*) remarkably like members of the *spinosus* group, which are oviparous and never green-blue to any conspicuous degree, it seems likely that it is in an ancestral position relative to both the *torquatus* and *spinosus* groups, although convergence and/or polyphyly cannot be ruled out completely. The karyological picture will undoubtedly cast decisive light upon this uncertainty.

This case in *Sceloporus* has been discussed here in considerable detail to document the fact that colors in life are vital bits of information, now grossly inadequate, that in many cases may be important in helping to determine relationships and phyletic patterns not only at the level of species and subspecies but also in superspecific groups even to the level of genus or subgenus.

In summary, all herpetologists - professional and amateur alike - face a golden opportunity for valuable contribution to their field by refocussing their attention from the hitherto much-too-common, strictly collecting aspects to the almost limitlessly fruitful aspects of behavior, color and population structure as observed in life in nature.

Acknowledgments. I am very grateful to Tom Stubbs and Drs. Alexander Cruz (University of Colorado), Yan Linhart (University of Colorado) and Robert L. Jeanne (Boston University) for their enthusiastic efforts to obtain "that new species of the *formosus* group" near Los Tuxtlas, Veracruz; as it developed, the revelation of a galaxy of new concepts is more rewarding than a new species.

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The Western Swamp Tortoise (*Pseudemydura umbrina*), One of Australia's Rarest Reptiles

A. J. Zwinenberg

ABSTRACT

A description of the rare western swamp tortoise, *Pseudemydura umbrina* Siebenrock 1901, occuring in two small areas near Perth (Western Australia) is given. Its biology is discussed, including data on its history and uncertain future.

HISTORY

In 1839 a specimen of an unknown tortoise was acquired by the Natural History Museum of Vienna (Austria) and labelled as "Phrynops Macquarrii, Nova Hollandia Jun" (Inv. nr. 1296). In 1901 the specimen was described by Friedrick Siebenrock as a new species, *Pseudemydura umbrina*. After that nothing additional was reported on this small reptile, which was thought to be extinct. However, in 1953 a school boy named Robin Boyd approached the organizers of the Western Australian Naturalists' Club Wildlife Show, since he was the owner of a pet tortoise of which he could not identify. The tortoise was brought to Mr. L. Glauert, then Director of the Western Australian Museum at Perth. He thought the tortoise was a new species and described it in 1954 as *Emydura inspectata*. Dr. Ernest Williams (1958) of Harvard University proved that Glauert's tortoise was synonymous with the long-lost *Pseudemydura* of the Vienna Museum, described in 1901. This rediscovery attracted much attention from herpetologists all over the world. The school boy's tortoise was found in a small area of the Swan Coastal Plain near a swamp in Bullsbrook, 35 kilometers northeast of Perth. After inspection of the area, additional specimens were found.

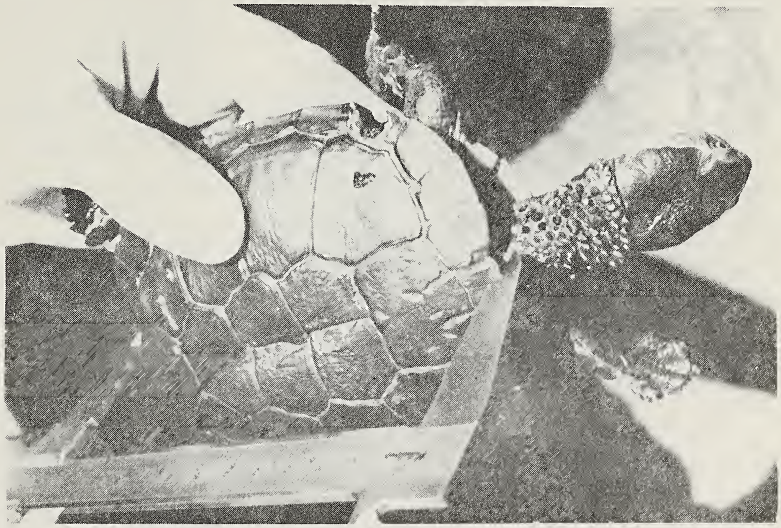
HABITAT AND POPULATION

The newly rediscovered western swamp tortoise, also called short-necked swamp tortoise or plate-shelled tortoise, has an extremely restricted distribution and a very low population density. It is found in two separate swamps, Twin Swamps and Ellen Brook, which were part of the most valuable agricultural land in Western Australia originally, but became wildlife sanctuaries in 1966.

The tortoise reserves, totalling 226 hectares, dry up in late spring or early summer. At this time the tortoise goes into aestivation for a period of about 6 months. With the approach of the winter rains (in April or May) the species becomes active for approximately 6 months.

The swamp areas consist of sandy soil with a wide range of vegetation. Banksia trees, zamia palms, acacias, paperbacks and tussocky grass are characteristic of these areas (Ellenbogen, 1971). Dr. A. A. Burbidge (1973) senior research officer in the Department of Fisheries and Fauna in Western Australia, has studied this species for many years. When he started his study in 1963 Twin Swamps held a population of about 150 spec-

imens. It contained all the necessary types of habitat for the survival of the species; Ellen Brook however, was only marginal habitat for the tortoise and its population density was much lower and estimated on 20 to 25 animals.



Photograph 1. Measuring the carapace of a reserve specimen. The notch in the carapace, cut in by a researcher, is part of a numbering system.

DESCRIPTION OF THE SPECIES

The western swamp tortoise is the smallest of the Australian side-necked tortoises (sub-order Pleurodira), which fold their neck sideways when the head is withdrawn into the shell; the head and neck lie under and along the front edge of the shell. There are about 50 species in the sub-order Pleurodira, living in different parts of the world, 12 (belonging to 4 genera) of them occur in Australia (Burbidge, et.al. 1974). They all belong to the family Chelidae. Burbidge, et. al. (1974) using morphological criteria recognized 15 species of Chelid tortoises from Australia and New Guinea (12 from Australia). Previously, Wermuth and Mertens (1961) listed 19 species (with 13 from Australia) and Worrell (1963) considering only Australia, listed 11 species. Goode (1967) listed 13 species for Australia and New Guinea (with 11 species occurring in Australia).

The males of *Pseudemydura umbrina* have an average carapace length of 140 mm, while the average carapace length of females is 126 mm. The animals vary in color with the type of swamp; in clay swamps the carapace is yellow-brown and in sandy swamps it shows an almost black color with a maroon tinge. The carapace is similar in color to the swamp-water. The plastron, which is almost as wide as the carapace, is pale yellow-brown, and areas of recent growth along the sutures are brown-black. In males the plastron is concave and in females flat. Males can be recognized since their tails are much thicker and somewhat longer. The neck is shorter than the ver-

tebral colomn and has large conical tubercles. Males average about 400 gms and females 325 gms. The head is broad, flat and olive colored. The underparts of head and neck are yellowish. The four feet are broad, partly webbed and equipped with strong claws.

Photograph II. Adult with young at a zoo in Perth.

ACTIVITY RHYTHMS AND RESEARCH

The swampland in which the tortoise lives dries up in late spring or early summer. At that time a period of six months of torpor begins during which the reptile finds refuge in leaf-litter, holes in the ground or under fallen branches. When entering a refuge it will dig until it reaches cool soil. Only the carapace may remain above the ground level, all other parts of the body are covered. When the reptiles are in aestivation the swampland is extremely dry, especially during long hot summers, and fire may cause serious damage. In 1973, a wild fire entered the reserve, but there are indications that no tortoises were destroyed. However, their habitat did receive some damage, as much of their cover was destroyed.

With the arrival of the first heavy winter rains some tortoises emerge and move to other locations, but most remain in their refuge until the swamps are filled with water. A period of great activity then begins.

To record movements, growth, age and numbers within the reserves radio tracking techniques are used. One of the reserves was fenced off and pits were dug along the perimeter. During their movements, the tortoises may reach the fence and unable to cross it, move along it thus falling into the pits where they are captured, measured, tagged and some fitted with radio-transmitting-packs. Such a pack consists of two plastic floats glued to each side of the carapace and each of which carries an aerial. Between these two floats, another pack carrying the battery and radio is glued to

the carapace. The radio emits a constant beep that is detected by a portable receiver fitted with a direction finder. A radio-packing tortoise can live a normal life and its movements can be tracked daily if necessary. The battery has a life of about one year but at this time, the whole pack becomes inoperative as the tortoise moults or changes the outer layer of skin on the carapace so that both skin and pack come off. Without the radio-tracking gear the movements of this rare species might never have been known as the tortoise is highly cryptic and very difficult to find, especially when aestivating. One important piece of data discovered by radio-tracking is that the population growth is slow, due to the fact that the young require nine years to achieve sexual maturity.

FOOD

Pseudemydura umbrina is a carnivorous reptile, like all members of the family Chelidae. However, there is one considerable difference; this species feeds only under water. Its diet consists of tadpoles, freshwater crustaceans, aquatic earthworms, insects and insect larvae. The feeding rhythms of this reptile are therefore associated with the filling of the winter swamps and the breeding behaviour of the local frogs and activities of the local crustaceans.

During aestivation it fasts, as the swamps dry out and its prey items are absent.

REPRODUCTION

Nesting takes place in November or early December. The female digs a shallow hole in the ground in which she lays three to five hard-shelled symmetrical eggs. After laying, the small clutch is covered with soil. They hatch in about 180 days, during May or early June. The young tortoises live beneath the surface soil. When the swamps are filled they emerge and a new generation of short-necked tortoises begins. At first they are grey above and bright cream and black below. Most growth takes place in late spring and early summer.

The species will not grow or breed when the swamps are dry and the climatic conditions between 1968 and 1973 have not been conducive to growth and breeding. Dr. Burbidge (1973) stated that "When we first monitored tortoise growth and numbers, we reckoned there were a total of 150 to 200 and observed a steady growth and reproduction pattern. Swamps were wet for six months of the year and the habitat was altogether ideal. But for the past few years, the swamps have been dry for eight to nine months each year. Growth rate has slowed down and there has been no reproduction since 1968. We think there are now 50 to 80 tortoises left". Mr. H. B. Shugg (1974), chief warden of fauna in Western Australia, informed me that the winter of 1973 has brought an average rainfall and that of 1974 an above average rainfall and stated, "As yet, there are no firm data on the breeding success of tortoises in the two reserves in either 1973 or 1974".

FUTURE

Since such a population of probably less then one hundred small tortoises in a confined area may be subject to natural disasters, etc. and possible extinction, an attempt to build a captive population has been made. In 1964 a number of swamp-tortoises arrived in the South Perth Zoo.

Photograph III. Two 8-day-old short-necked tortoises. The coin has a diameter of 26 mm.

After some time in captivity it became apparent that the captive tortoises had developed a condition resulting in a carapace of much poorer quality than the reserve tortoises. The "domesticated" tortoises basked in the sun, a habit wild tortoises apparently do not have. Females captured at the fence pits in the reserve were x-rayed and if they were gravid, they were kept in captivity and the eggs placed in nesting pits. Unfortunately, hatching and rearing success has not been very good, partly because our knowledge of this peculiar reptile was and is still rather inadequate. Today (end 1974), approximately 15 animals, including some that have been bred there, are living in the zoo at Perth. To insure the existence of the species, steps are taken concerning pollution, drainage and fire control in the reserves. Because the State Government Department of Fisheries and Fauna - the authority in charge of fauna reserves in Western Australia - acquired more land just outside the tortoise reserves unwanted swamp drainage could be prevented and pollution from outside is currently negligible. Firebreaks and fire lookouts were planned and carried out. Seasonal trends form an unmanageable factor, however, and may cause serious damage to the tortoise habitat, as previously described. A previous heavy summer rain did cause some damage, because the reptiles were in aestivation when it hit.

In spite of all of this, Dr. Burbidge is not overly concerned since the species has shown it is hardy and can adapt to seasonal fluctuations.

Dr. Burbidge estimated in December 1974, that there are possibly only 50 - 80 tortoises in the Reserves. His research is continuing, but he is concerned at the types of land use in the areas surrounding the Reserves. At least one pig farm has been established in an adjoining property and

it is feared that others may be developed. "It seems that we will have to not only ensure that the pigs are kept out of the Reserves, but to ensure that the tortoises cannot leave them, as they would be eaten by pigs!"

Distribution Map

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NOTES ON THE HERPETOLOGY OF PRESQUE ISLE STATE PARK ERIE, PENNSYLVANIA

I conducted a survey of snakes, turtles, and salamanders inhabiting selected representative sites on Presque Isle State Park, Erie, Pennsylvania during the summer and autumn of 1974. This park is a 3,100 acre peninsula which arises from the south shore of Lake Erie. The park contains sandy beaches, plains, swamps, ponds, and woodland.

The primary purpose of this survey was to supply information to the Northwestern Pennsylvania Environmental Data Center. This information may be useful in the formulation of environmental impact projections such as two recently prepared on Presque Isle State Park (Michael Baker, Jr., Inc., 1974; U.S. Army Engineer District, 1973). While these publications contain information on various forms of life, such as plants, fish, and birds, detailed information on herptiles inhabiting the park is lacking. Perhaps the impetus of certain special interest groups accounts for the wealth of written information on certain forms of life in the park. For example, The Presque Isle Audubon Society has studied the birds of this area.

A second purpose of this survey was to more thoroughly investigate the difference in the number of snake species seen between the northwestern Pennsylvania mainland and Presque Isle State Park. McKinstry and Felege (1974) observed nine species on the mainland but only three species in the park.

To initiate the survey four collection sites which together represent the beaches, sandy plains, swamps, and woodlands of the park were selected. The designation, location, size, and nature of each site is as follows:

Fig. 1. Site A. Grassy trail bordered by pine trees.

Site A. Fig. 1. This area, opposite the Beach 10 upper parking lot, is inland and roughly parallel to Peninsula Drive. The site measures 900 m x 120 m with the long axis on an east-west line. Site A contains a 900 m grassy trail which is bordered by mature pines (north side) and a swampy plain (south side). A clearing containing dunes and a decaying board pile occupies the western end of the site.

Fig. 2. Site B. Large inland plain.

Site B. Fig. 2. This area is about 420 m south of Site A. The site measures 1,500 m x 150 m with the long axis on an east-west line. Site B is a large grassy plain which contains scattered dunes, swamps, and stands of shrubs and pines. A 1,500 m trail runs through the site.

Site C. Fig. 3. This area is east of the Beach 10 upper parking lot. The site measures 900 m x 300 m with the long axis on an east-west line. Site C, which extends to Lake Erie, is an open grassy sand plain which contains dunes and shallow intermittent ponds. Cottonwoods, willow trees, and rushes are common.

Site D. Fig. 4. This area is known as the Sidewalk Trail-Cranberry Pond area. The site measures 1,200 m x 420 m with the long axis on an east-west line. Site D is a hardwood forest which exhibits, in many areas, a dense canopy. Inland ponds, shallow intermittent swamps, and sandy ridges are present.

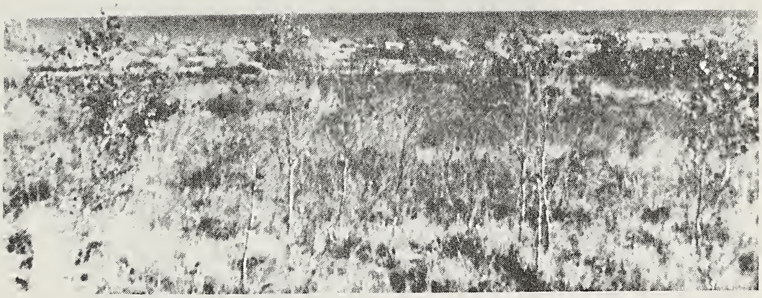

Fig. 3. Site C. Plain extending to Lake Erie.

Fig. 4. Site D. Hardwood forest with dense canopy.

Each site was visited one to five times per month during the period between 3 July 1974 to 7 November 1974. All collecting trips were made in the daytime. The duration of each site inspection was one to three

hours. Traditional collecting methods, i.e. search of dead bark, logs, and boards as well as careful inspection of exposed habitats, were employed. The identity and habitat of each specimen collected was recorded. Occasional specimens eluded capture but were usually identified by their field markings.

Three species of snakes, two of turtles, and two of salamanders were collected during this survey as follows: Snakes - eastern garter snake (*Thamnophis s. sirtalis*), northern ribbon snake (*Thamnophis s. septentrionalis*), northern brown snake (*Storeria d. dekayi*); Turtles - map turtle (*Malaclemys geographica*), midland painted turtle (*Chrysemys picta marginata*); Salamanders - red-spotted newt-red eft stage only (*Notophthalmus v. viridescens*), spotted salamander (*Ambystoma maculatum*). Specifics as to numbers of specimens collected in the various sites each month appear in tables 1a and 1b.

Table 1a. Snakes observed on Presque Isle State Park during the summer and autumn of 1974.

		Number Of Specimens Observed			
Site and Month	No. Visits	*T. s. sirtalis*	*T. s. septentrionalis*	Striped[e] snake	*S. d. dekayi*
A[a]					
July	1	6	0	0	2
Aug.	4	2	1	2	1
Sept.	4	1	0	0	1
Oct.	3	10	4	0	3
Nov.	1	0	0	0	0
B[b]					
July	3	7	0	5	1
Aug.	3	4	1	1	1
Sept.	4	4	1	4	0
Oct.	3	17	3	2	0
Nov.	1	0	0	0	0
C[c]					
July	3	8	0	0	2
Aug.	4	3	0	0	2
Sept.	5	8	0	2	4
Oct.	3	8	0	0	1
Nov.	1	0	0	0	0
D[d]					
July	3	0	0	0	0
Aug.	4	0	1	0	0
Sept.	5	0	0	1	0
Oct.	3	0	0	0	0
Nov.	1	0	0	0	0

Table 1b. Turtles and salamanders observed on Presque Isle State Park during the summer and autumn of 1974.

Site and Month	No. Visits	Number Of Specimens Observed: *M. geographica*	*C. p. marginata*	*N. v. viridescens*	*A. maculatum*
A					
July	1	0	0	0	0
Aug.	4	0	0	0	0
Sept.	4	0	0	1	0
Oct.	3	0	0	1	0
Nov.	1	0	0	15	0
B					
July	3	1	0	0	0
Aug.	3	0	0	0	0
Sept.	4	1	0	4	0
Oct.	3	0	0	2	0
Nov.	1	0	0	0	0
C					
July	3	0	2	1	0
Aug.	4	0	0	0	0
Sept.	5	0	0	1	0
Oct.	3	0	0	0	0
Nov.	1	0	0	0	0
D					
July	3	0	0	0	5
Aug.	4	0	0	33	9
Sept.	5	0	0	79	9
Oct.	3	0	0	80	3
Nov.	1	0	0	0	0

[a]Site A = grassy trail between pine stand and swampy plain.

[b]Site B = inland grassy plain.

[c]Site C = grassy plain bordering on Lake Erie.

[d]Site D = inland woodland.

[e]Striped snakes = *T.s. sirtalis* or *T.s. septentrionalis*

In a previous survey (McKinstry and Felege, 1974) the ribbon snakes inhabiting the park were identified as the eastern variety *Thamnophis s. sauritus*. This identification now appears erroneous since the ribbon snakes collected in the present survey more closely match the description (dark-brown or black dorsal surface) and range of the northern ribbon snake, *Thamnophis s. septentrionalis* as given by Cochran and Goin (1970).

The eastern garter snakes and northern brown snakes were observed to prefer open grassy habitats (Sites A, B, and C). Both species were often collected from under old boards and logs in these areas. The northern brown snakes almost always preferred these hiding places. The northern ribbon snakes were usually seen on the open floor of a pine stand or in grassy areas (Site A). These snakes were never observed under boards or logs. On cool (15 - 20° C) sunny days in October the eastern garter snakes and northern ribbon snakes were particularly abundant. During a three hour collecting period in late October, 18 of these reptiles were observed. The two types of turtles were collected in open sandy areas near ponds (Sites B and C). The red efts were always observed under damp boards or logs and were most abundant in woodland areas close to ponds (Site D). The spotted salamanders were only seen under logs in damp woodland habitats (Site D).

This survey does not add new information as to the general range and habitats of the species collected. It does, however, provide up to date information on the occurrance of reptiles and salamanders in an easily alterable locality in northwestern Pennsylvania - Presque Isle State Park. Winter storms with resulting wave action and flooding and/or possible construction projects could alter the park and perhaps change its herpetofauna from that seen today.

This survey outlines more thoroughly the occurrence of the three species of snakes observed in the park by McKinstry and Felege (1974). If other species occur, in the areas examined, they have eluded out attention during the past several years.

The assistance of Nancy, Michael and Patrick Reed McKinstry during portions of this survey is greatly appreciated.

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—Donald M. McKinstry, *Department of Biology, The Pennsylvania State University, Behrend College, Erie, Pennsylvania 16510.*

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Accepted 1 February 1975

A Maryland Hibernaculum of Northern Brown Snakes, *Storeria d. dekayi*

Few published accounts exist concerning hibernation in Maryland amphibians and reptiles. Cooper (1956b) reported *Chrysemys p. picta*, *Notophthalmus v. viridescens* and a single *Rana pipiens (=R. u. utricularia)* hibernating in flood plain puddles. Cooper (1956a) also reported on the aquatic hibernation of *Plethedon c. cinereus*. More recently, Lee (1968) reported on springs as hibernation sites for *Coluber constrictor*, *Lampropeltis doliata (=L. triangulum)*, *Diadophis punctatus*, *Heterodon platyrhinos*, *Natrix sipedon*, *Elaphe obsoleta*, *Agkistrodon contortrix*, *Clemmys guttata*, *Rana clamitans*, *Rana pipiens*, *Eurycea bislineata*, *Eurycea longicauda*, *Desmognathus fuscus*, *Pseudotriton ruber*, and *Plethodon cinereus*. Older published records do exist, but they are scant.

Since, little is known of the various hibernaculums utilized by Maryland snakes, the following may be worthy of note.

On 27 February 1975 while doing construction work in Baltimore County, on Wilkins Avenue just off of US 695, William V. Horvath discovered 4 hibernating northern brown snakes, *Storeria d. dekayi*. The snakes were found during digging operations approximately 8 inches below the surface of the ground on the slope of a hill that has a southern exposure. Two adults and two juveniles were discovered together in a group. The approximate air temperature was 40° F and the snakes were very sluggish when found. They were placed in a jar in a heated vehicle at which time they became very active. Another attempt was made by Horvath to locate additional specimens on 3 March at the above locality without success.

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1956a. Aquatic hibernation of the red-backed salamander. *Herpetologia* *12*:165.

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1968. Springs as hibernation sites for Maryland's herpetofauna. *Bull. Md. Herp. Soc.* *4*(4):82-83.

—William L. Grogan, Jr., *Department of Entomology, University of Maryland, College Park, Maryland 20742.*

Received 8 March 1975

Accepted 8 March 1975

Longevity Record for the Striped Newt, *Notophthalmus perstriatus*

The striped newt, *Notophthalmus perstriatus*, reported by Grogan and Bystrak (1973), has since died. This specimen, an adult male, was purchased as an adult from a pet shop on 21 December 1961 and kept in captivity until its death on 11 December 1974, a period of 13 years. At death its snout-vent and total length are 50 and 104 mm respectively. These measurements differ slightly from those reported by Grogan and Bystrak (1973) taken when the specimen was alive, but still exceed the maximum total length recorded by Conant (1958) for this species by approximately 1 inch (25 mm). Conant (1973) indicated that this specimen is by far the largest reported for this species. This specimen is catalogued A 2880 NHSM in the herpetological collection of the Natural History Society of Maryland.

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Grogan, W. L., Jr. and D. Bystrak.
1973. Longevity and size records for the newts *Notophthalmus perstriatus* and *Notophthalmus v. viridescens*. *HISS News-J.* *1*(2): 54.

—William L. Grogan, Jr., *Department of Entomology, University of Maryland, College Park, Maryland 20742.*

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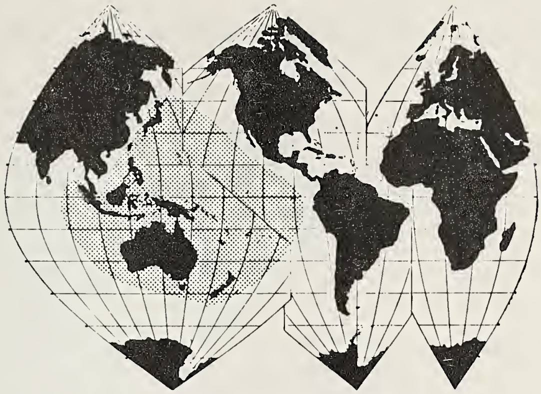
News & Notes



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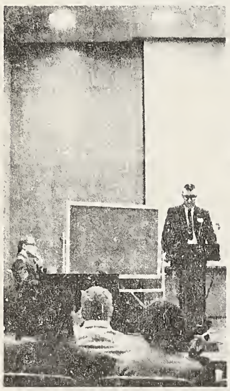

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DEPARTMENT OF HERPETOLOGY

THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

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JUNE 1975

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 11 30 JUNE 1975 NUMBER 2

AN ANNOTATED CHECKLIST AND KEY TO THE SAUROFAUNA OF SOUTHEASTERN AND CENTRAL SPAIN

Achim R. Börner

This article was prepared as a hand-list for use in the field, when the author had the opportunity to spend a few days in southeastern Spain. It is primarily based on the checklist of Europe by Mertens and Wermuth (1960). The region covered by the present synopsis is delineated in Fig. 1. General literature on the region includes Hellmich (1956, 1962), Klemmer (1963), Mertens (1925), and Pasteur and Bons (1960).

fig. 1 Map of Spain depicting the region under study.

Annotated Checklist to the Saurofauna of Southeastern and Central Spain

Anguidae

Anguis f. fragilis (LINNAEUS), 1758

Type locality: Sweden

Chamaeleonidae

Chamaeleo c. chamaeleon (LINNAEUS), 1758

Type locality restricted by Mertens and Müller (1928): North Africa

The chamaeleon is said to be very rare in southern Spain and therefore should not be collected.

Geckonidae

Hemidactylus t. turcicus (LINNAEUS), 1758

Type locality restricted by Schmidt (1953): Asian Turkey

Tarentola m. mauritanica (LINNAEUS), 1758

Type locality: Mauritania

An adult specimen typical of this Mediterranean gecko was found on a rock near the footpath from the lookout to the old harbour, Benidorm; it was taking a sunbath early in the morning.

Lacertidae

This family, contributing the major element of the European saurofauna, is poorly known despite all of the efforts of European herpetologists and the tens of thousands of specimens amassed in museum collections. Since Boulenger (1920/1921) no one has undertaken the time consuming and painstaking job to attempt a revision of a larger subspecies, or species complex; the outstanding exception is the very few, however, who did not deal with the Spanish lizards such as Broadley (1972), Darevsky (1967), Eisentraut (1949), Lantz (1928/1930), and Peters (1962).

This chaotic situation, especially in the genera *Lacerta* and *Eremias* and their close allies, is reflected by our current knowledge of the Spanish forms; e.g. we know neither the number of wall lizard species nor their variation at the subspecific level. Therefore it is deemed necessary to give all names assigned to *Lacerta hispanica* in the region, although many are considered synonyms.

Genus *Acanthodactylus*

Acanthodactylus e. erythrurus (SCHINZ), 1833

Type locality: Spain

Genus *Algyroides*

All Spanish forms in this genus are rare. Their occurance is sporadic, as they all require a high air-humidity. This is-

olation of populations effects subspecific diversity, which, due to the scarcity of specimens, is unknown. See Buchholz (1964) and Klemmer (1960) for additional data.

Algyroides hildagoi BOSCA, 1916

Type locality: San Ildefonso, 1192 m elev., Sierra de Guadarrama, central Spain

Known only from the holotype, which apparently has been lost.

Algyroides m.marchi VALVERDE, 1958

Type locality: Piedro de Aguamula, Sierra de Cazorla, Province of Jaén

Algyroides marchi niethammeri BUCHHOLZ, 1964

Type locality: near the mountain pass (1480 m elev.) at ca. 1430 m elev., road from Alcaráz to Riópar, Sierra de Agua, Province of Jaén, southeastern Spain

Known only from the holotype.

Genus *Lacerta*

Additional data on the systematics of this group can be found in Buchholz (1963), Cyrén (1928, 1934), and Klemmer (1959).

Lacerta hispanica STEINDACHNER, 1870

It is not known, whether *Lacerta bocagei* SEOANE, 1844 is a distinct species or represents only a subspecies of *L. hispanica*. If it is indeed distinct on the specific level, a rearrangement of other subspecies, which are currently defined as *L. hispanica*, is warranted.

A female specimen, nearly 6 cm snout-vent length, from Isla de Benidorm (the island opposite to the famous hotel - town of Benidorm), and its habitat are depicted in the photos (figs. 2, 3, 4). The island is densely populated with lizards, whereas they are shy and very rare on the mainland (sight records exist from the mountains east of Playa Levante, Benidorm).

Lacerta h. hispanica STEINDACHNER, 1870

Type locality restricted by Mertens and Müller (1928): Monte Agudo near Murcia, southeastern Spain

Lacerta muralis steindachneri BEDRIAGA, 1886 was made a junior synonym of this race by Mertens and Wermuth (1960), who restricted its type locality to that of the nominate form. Klemmer (1959) was unable to find a single lizard at the type locality.

Lacerta hispanica liolepis BOULENGER, 1905

Type locality: town of Valencia, Spain

Described as a variety of *L. muralis*, it was then referred to *L. bocagei*, and later reduced to a junior synonym of the nominate species.

fig. 2 *Lacerta hispanica*, adult female from Isla de Benidorm

Lacerta hispanica vaucheri BOULENGER, 1905

Type locality: Tanger, northwest Africa

The lizards in the extreme south of Spain are referred to this race, which is considered valid.

Lacerta hispanica guadarramae BOSCA, 1916

Type locality: San Ildefonso, Sierra de Guadarrama, central Spain

This name is tenatively considered a junior synonym of the nominate subspecies.

Lacerta l. lepida DAUDIN, 1802

Type locality restricted by Mertens and Wermuth (1960): southern France

Lacerta lepida nevadensis BUCHHOLZ, 1963

Type locality: North-slope of the Pico Veleto, between 1600 m and 2100 m elev., Sierra Nevada, south Spain

Lacerta monticola cyreni Müller & Hellmich, 1937

Type locality: Puerto de Navacerrada, Sierra de Guadarrama, Spain.

Lacerta sicula ssp.

introduced in Alméria according to Mertens and Wermuth (1960)

Genus *Psammodromus*

Psammodromus a. algirus (LINNAEUS), 1758

Type locality: Mauritania

Ash-gray specimens were observed on the walls and in the gardens of Alméria Castle, Alméria. Normally the back has a brownish or olive color.

Psammodromus h. hispanicus FITZINGER, 1826

Type locality restricted by Mertens and Müller (1928): Southern Spain.

Psammodromus hispanicus edwarsianus (DUGES), 1829

Type locality: Southern France

The zone of intergradation between both subspecies is of special interest. Studies in this zone may reveal the distinctiveness of the forms on the specific level.

Scincidae

For the systematics of this group see Klausewitz (1954) and Pasteur and Bons (1960).

Chalcides bedriagai BOSCA, 1880

Type locality restricted by Mertens and Müller (1928): Dosaguas, Valencia

Chalcides chalcides striatus (CUVIER), 1829

Type locality: Southern France

The validity of this form requires further examination.

fig. 3 Lizard habitat on Isla de Benidorm

Artificial Key to the Saurofauna of Southeastern and Central Spain

1. Limbless . . . . *Anguis f. fragilis*
1. Limbs present 2
2. Underside of toes with transversely enlarged lamellae (scansors) . . . . 3 (Geckonidae)
2. Digits in two opposable sets of 2 and 3 . . . . *Chamaeleo c. chamaeleon*
2. Digits not so, separate 4
3. Underside of digits with one row of scansors . . . . *Tarentola m. mauritanica*
3. Underside of digits with two rows of scansors . . . . *Hemidactylus t. turcicus*
4. Ventral scales not differentiated . . . . 5 (Scincidae)
4. Ventral scales well differentiated from the dorsals . . . . 6 (Lacertidae)
5. Limbs reduced, each with three digits . . . . *Chalcides chalcides striatus*
5. Limbs relatively well developed, each with five digits . . . . *Chalcides bedriagai*
6. Pileus without an occipital; only two supraoculars . . . . *Acanthodactylus e. erythrurus*
6. Pileus with an occipital; four supraoculars 7
7. Dorsal scales large, rhombic, relatively strongly keeled, imbricate 8
7. Dorsal scales small, rounded, weakly keeled or not keeled, not imbricate . . . . 13 (*Lacerta*)
8. Ventral scales squarish; well differentiated collar scales . . . . 9 (*Algyroides*)
8. Ventral scales rhombic; collar scales discernible only on the sides of the throat . . . . . . 11 (*Psammodromus*)
9. Dorsum uniformly brownish with vague dark spots on the vertebral line; dorsals sharply keeled; 17 rows of dorsals around the middle of the body . . . . *Algyroides hildagoi*
9. Middle of dorsum light brown with sharply defined spots on the vertebral line; sides of the trunk dark brown; dorsals not so sharply keeled; 24 to 31 rows of dorsals around the middle of the body . . . . 10 (*Algyroides marchi*)
10. 24 to 29 dorsals around the middle of the body; throat whitish or yellow . . . . *Algyroides m. marchi*
10. 31 dorsals around the middle of the body; throat deep blue (only in adult males?) . . . . *Algyroides marchi niethammeri*
11. On each side of the back a longitudinal yellow stripe; length of unregenerated tail doubles snout-vent length, which exceeds 7 cm . . . . *Psammodromus a. algirus*
11. Longitudinal stripes only as juveniles: 4 to 6 of them along the back, composed of light spots; adults uniform or with dark spots; length of unregenerated tail never exceeds double snout-vent length; snout-vent length does not exceed 5 cm . . . . 12 (*Psammodromus hispanicus*)

12. 30 to 34 dorsals around the middle of the body; subocular reaches the mouth; greenish in life . . . *Psammodromus h. hispanicus*
12. 34 to 43 dorsals around the middle of the body; one or two small scales separate the subocular from the mouth; not greenish . . . . *Psammodromus hispanicus edwarsianus*
13. Ventral scales like a trapezium . . . . 14 (*Lacerta lepida)*
13. Ventral scales squarish . . . . 15 (wall lizards)
14. 65 to 70 dorsals around the middle of the body; ocellated, black scales irregularly distributed . . . . *Lacerta l. lepida*
14. 76 to 90 dorsals around the middle of the body; ocelli faded, no black scales . . . . *Lacerta lepida nevadensis*
15. Dorsals at least weakly keeled; scales of unregenerated tail in distinct whorls, broad and small ones alternating . . . . *Lacerta monticola*
15. Dorsals not keeled; scales of unregenerated tail in whorls of equal length 16
16. Underneath uniformly colored, except the outer rows of the ventral scales; differentiated large temporal (massetericum) . . . . *Lacerta sicula*
16. Underneath black spots, at least on the throat; massetericum normally missing . . . . *Lacerta hispanica*

fig. 4 Isla de Benidorm, seen from the mainland

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GRIST FOR THE MILLS OF HERPETOPHILES IN MEXICO

Hobart M. Smith

The limitless opportunities for new discoveries in the amazingly complex diversity of the herpetofauna of Mexico cannot be catalogued. The cream has been skimmed from the basic work of faunal exploration, as noted several years ago by one of the greatest herpetologists of our country, W. E. Duellman, even though new taxa, significant range extensions and taxonomic rearrangements will continue to be discovered frequently for many years, and occasionally for many decades. Every new road makes accessible many such discoveries. Nevertheless the fact remains that the alpha phase of basic exploration is no longer dominant; now the experimental and observational phase is rapidly developing, with emphasis in the field upon behavioral and demographic studies, which have gained a great advantage over the strict collecting of the alpha phase through the imposition of severe regulations curbing wanton collecting and importation of amphibians and reptiles.

One of the most exciting prospects for field observation in Mexico at this particular time is the determination of the basic facts in the life cycle of the high-altitude lizard *Sceloporus aeneus aeneus*, common in the mountains between Mexico City and Cuernavaca, and occurring rather widely elsewhere in the southern mountains of the main Mexican plateau. It would be a simple, delightful and rewarding experience, especially for a family, justifying protracted or repeated stays in Cuernavaca or some other strategically situated base (see Fig. 1) near the range of this subspecies, to launch an investigation to settle once and for all the basic questions of the life cycle of this lizard.

It would take an outstandingly significant problem to justify such a proposition, but the qualification exists. There is an outside chance that *S. a. aeneus* may prove to be the only lizard in the world known to reproduce in alternate years. This is the problem for the solution of which so far there is nothing but speculation, but which could be solved by even one, and certainly by two, appropriately chosen, brief periods of observation.

Even such a basic matter as method of "parition" (i.e., by parturition or oviposition) remains to be established in this subspecies. Such information does not come easily, for the critical period usually arrives in spring when human collectors are occupied with other matters, such as a fixed schedule of work or school; when they are free, in summer, it is too late for immediately conclusive evidence to be obtained. Only in 1962 (Anderson) was it demonstrated that the only related member of the group occurring in this country (*S. scalaris slevini*) is oviparous. It was established long ago that *S. scalaris scalaris* is oviparous (Herrera, 1890:

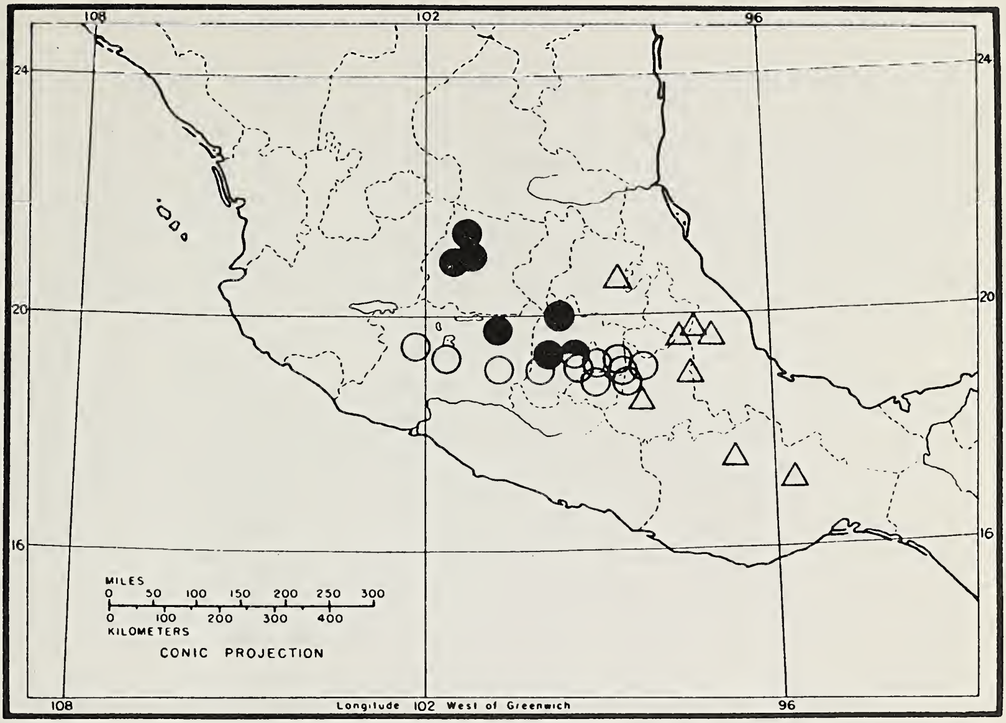

Fig. 1. Localities recorded for the three subspecies of *Sceloporus aeneus*. Triangles, *S. a. bicanthalis*; circles, *S. a. aeneus*; dots, *S. a. subniger*; half-circle, half-dot, intergrades between *S. a. aeneus* and *S. a. subniger*. Adapted from Zool. Ser. Field Mus. Nat. Hist., 26:357, fig. 57, 1939.

331), and in 1939 Smith (1939:356) recorded that *S. aeneus bicanthalis* is viviparous.[1] Gadow (1905:214) stated that *S. scalaris* is "ovoviviparous," but clearly in error, probably in reference in reality to either *S. a. aeneus* or *S. a. bicanthalis*. This is the only reference even possibly noting method of parition in *S. a. aeneus*, and these are the only taxa of the whole *scalaris* group for which such information had been recorded, until 1974 when Smith and Hall recorded the occurrence of viviparity in *S. goldmani*. They went on however to propose that viviparity is the norm in all subspecies of *S. aeneus* as well as in *S. goldmani*, and that all subspecies of *S. scalaris* are oviparous, leaving in abeyance the parition method of the only other assigned member of the group, *S. jalapae*. Such a proposition required however that they really crawl out on a limb to propose that *S. a. aeneus* normally reproduces biennially.

[1] Viviparity is a term here used, as it should always be to avoid confusion, in its broadest sense in reference merely to live-bearing, without implication of presence or absence of a placenta, rudimentary or not. Ovoviviparity is a type of viviparity in which placental structures

That proposition stems from the proposal by Davis and Smith (1953: 102) that *S. a. aeneus* is oviparous, thereby requiring specific status since *S. a. bicanthalis* is incontrovertibly viviparous. The data on which the inference of oviparity was based were summarized as follows: "Ten of the 28 females, collected from July 25 to August 15, contained from 3 to 5 (average, 4) large ova, the largest measuring 6 X 12 mm; 12 of the others appeared to have oviposited and in the others the ova were minute, less than 1 mm in diameter. In none of the large ova was there any recognizable evidence of embryonic development." The assumption was, of course, that the females with no or minute eggs had already laid their eggs, whereas those with large eggs would have laid them later in the same season.

In more mature consideration, however, it is evident that eggs in which no visible embryonic development had yet taken place could not be laid after mid-August and still hatch before winter. The altitude (around 3,330 m) and normal weather pattern preclude rapid development; even in midsummer, nights are unpleasantly cold, and freezing weather comes early. Winter snows are commonplace. It now seems more reasonable to infer that the females with large eggs would have carried them over winter and have given birth to their young in late spring and early summer. They would have redeveloped small eggs by fall, duplicating the members of the group described by Davis and Smith with small eggs. The eggs would have reached larger size by the fall of the following year, and the young would have been born the following spring and summer.

Although available data suggest the possible validity of the hypothesis of occurrence of a biennial reproductive cycle in *S. a. aeneus*, at least in the Tres Cumbres area of Morelos, three considerations suggest contrariwise: (1) no lizard anywhere in the world has been recorded to have a biennial cycle, according to Fitch (1970), although several northern species of snakes (e.g. *Crotalus viridis, Vipera berus, V. aspis, Thamnophis sirtalis, T. radix*) are known or thought to have either biennial or triennial cycles (Fitch suggests that the extended cycles are better interpreted as irregular cycles); (2) lizards, especially small *Sceloporus*, are too short-lived for a biennial cycle, especially of viviparity, to sustain the species (the snakes are much longer-lived); and (3) other species of lizards under apparently equally great or greater environmental stress maintain an annual cycle.

are present. Histological examination is necessary to determine whether any given viviparous species is ovoviviparous or euviviparous, and even then the distinction may be argumentative. Except where histological study has confirmed the presence or absence of a placenta - and very few species of reptiles have been studied in this context - it is best always to use the term of broadest meaning in reference to non-mammalian vertebrates, since only in the viviparous mammals is a placenta assured.

The alternative to viviparity is, of course, oviparity. These two types, and their subtypes, if any, constitute the parity types, the term parity occuring with this meaning in most dictionaries. The act of parity, i.e. of laying eggs or giving birth, is properly referred to as "parition" (a new word), and the condition of parity is properly referred to as the "parous" condition (an established word).

Obviously the mere fact that no lizard is yet known to have an extended reproductive cycle is inconsequential except as it makes the establishment of such species of exceptional interest. As for the longevity of *S. a. aeneus*, nothing is known, but an extrapolation from data on related and other small species of lizards suggests a life span almost certainly not exceeding 10 years, and quite likely not frequently exceeding 5 years. Northern species in general, however, subjected as they are to cold-induced inactivity much of the year, are longer-lived and have more protracted reproductive cycles than do their more temperate relatives. The same generality may apply equally well to high altitude species as compared with their lower-altitude relatives.

Finally, although several other species of iguanid lizards reach altitudes considerably greater than does *S. a. aeneus*, all so far as I am aware are conspicuously heliophilous, insolating extensively on trees or rocks. Some high-altitude lizard populations may indeed have polyennial reproductive cycles, for they have not been observed exhaustively; on the contrary northern lizard populations have been studied thoroughly and seemingly do not deviate from the norm of annual reproductive cycles. However, it is quite possible that through extreme heliophily most high-altitude lizards so protract their activity that an annual reproductive cycle may be maintained. An example is the sympatric (with *S. aeneus*), viviparous *S. grammicus microlepidotus*, which ranges to a much higher altitude (4750 m) than *S. aeneus*, but is strongly heliophilous and seemingly reproduces annually.

On the contrary, *S. a. aeneus* is not given to conspicuous insolation, but is secretive, terrestrial and graminicolous, thus exposed to the maximum developmental retardation of the cold weather characteristic within its range. Even if it were known to have a lower optimum activity temperature (not established, but possible) than other sympatric species, it would not necessarily thereby escape the need for a biennial cycle; *Sphenodon*, with the lowest optimum activity temperature of any living reptile, has a protracted reproductive cycle (± 13 mo.), although its freedom from temperatures in the freezing range permits a more rapid development of embryos than would be possible in the strongly seasonal weather to which *S. a. aeneus* is exposed. *Sphenodon* in the habitat of *S. a. aeneus* would probably also require two years for completion of one reproductive cycle.

Thus the facts of the reproductive cycle, longevity and population structure of *S. a. aeneus* stand as one of the most rewarding goals toward which any herpetologist may work in Mexico. Unlike many problems, these have answers that are readily accessible, awaiting merely the determined attention of anyone willing to devote a little time and effort to them.

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CLASSIFICATION, DISTRIBUTION AND SUBSPECIATION

Fig. 1. The distribution of *Chelonia mydas*.

Chelonia mydas and five other species of sea turtle belong to the family Cheloniidae, which in turn with the family Dermochelidae form the superfamily Chelonoidea of the order Testudinata. The species was first described as *Testudo mydas* in 1758 by the famous Swedish naturalish Linnaeus (type locality Ascension Island in the Atlantic Ocean). In 1800 the generic designation *Chelonia* was introduced by Bronniart. Since that time, specimens of the green turtle have often been mistaken for a new species and described as such. The list of names in the synonymy of *C. mydas* has become quite long.

C. mydas lives in shallow waters, mostly in coastal areas, far from its breeding grounds. It wanders through all tropical seas, since at regular intervals it travels to sandy shores to lay eggs. Between the feeding grounds and breeding grounds may lie hundreds of miles of open sea; specimens tagged at Ascension Island were recaptured near the coast of Brazil, about 2200 kilometers away (Cronnie, 1971).

The green turtle is usually found within 35 degrees north and south of the equator (Loveridge, 1946). It prefers seas with an average temperature of surface water during the coldest month of above 20° C (Hirth, 1971). However, wanderers are seen or caught at more northerly points (e.g. in Newfoundland waters, near British Columbia and Japan). The southernmost records are from coastal areas of northern Argentina, Chile and New Zealand. There is considerable variation in the color of green turtles, which has resulted in the description of a number of subspecies. Hirth (1971) recommends the use of the binomial *Chelonia mydas* for all green turtles until a detailed taxonomic study can be made. Brongersma (1964) is also of the opinion that a detailed study ought to be made, before valid subspecific identification is possible. He noted that such a study would be difficult and time consuming. There are, however, a number of indications

which make it plausible that the green turtle can be divided into a few subspecies. Bustard (1973) indicates that a number of well-differentiated populations exist and what is currently called the 'green turtle' could prove to be a composite of two or more quite distinct species.

In general the following subspecies are recognized:

Chelonia mydas mydas (Linnaeus), the Atlantic green turtle, found in the Atlantic Ocean, Caribbean Sea, Gulf of Mexico and the Mediterranean (Conant, 1958; Mertens and Wermuth, 1960; Hirth, 1971).

Chelonia mydas agassizii Bocourt, the east Pacific green turtle, found mainly along the Pacific coasts of Central and South America (Hirth, 1971; Stebbins, 1966).

Chelonia mydas carrinegra Caldwell, the northeastern Pacific green turtle, occurs in great numbers in the Gulf of California. This subspecies was described in 1962 by D.K. Caldwell. Other herpetologists (Hirth and Carr, 1970; Pritchard, 1971) have since concluded that this dark form was nothing more than a sterile mutant form of *C.m. agassizii*. Schulz (1968) does not recognize this subspecies.

Chelonia mydas japonica (Thunberg), the western Pacific green turtle, probably only living near Japan and ranging as far east as the Hawaiian Islands. Worrell (1963) lists it as a full species for Australian waters *(Chelonia japonica)*, and gives the range as Pacific and Indian Oceans. He mentions that there is a nesting site near Bundaberg (Queensland). It is likely that this species should be placed in the synonymy of *Chelonia depressa*, decribed by Garman in 1880 and the least known of the world's sea turtles. *Chelonia depressa*, the flatback turtle, breeds on the coast and islands offshore of northeastern Queensland, and is often mistaken for a green turtle. The flatback differs mainly in having a strongly depressed carapace with an upward curve at the edge (Bustard and Limpus, 1969).

CHARACTERISTICS

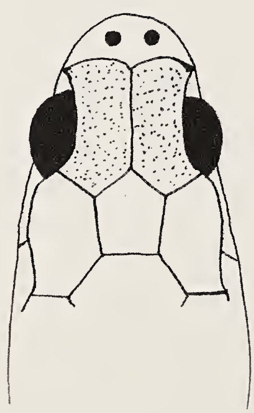

Fig. 2. The characteristic large prefrontal plates of *Chelonia mydas*.

The carapace of *C. mydas* is not completely ossified; it is smooth and has 4 costal shields (costals) on each side, the 1st not touching the nuchal. The other horny shields of the carapace are: 2 supracaudals, 11 marginals on each side and 5 vertebrals. The large scutes of the carapace do not overlap, except in very young turtles. The fore-flippers only bear a single claw. The jaws are not so remarkably hooked as in *Dermochelys coriacea*. The cutting edge of the lower jaw is coarsely toothed (Fig. 3), while the

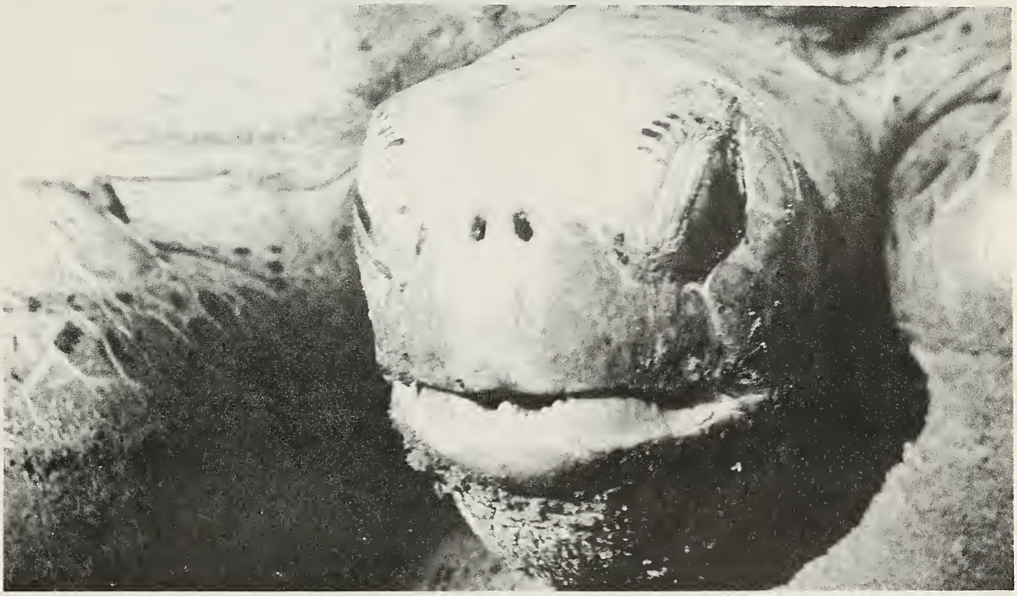

Fig. 3. The head of *Chelonia mydas* ♀.

upper jaw is provided with strong ridges on its inner surface. Between the eyes a pair of large prefrontal plates are visible (Fig. 2). Males can be recognized by their tail, which is much longer than in females. Moreover their carapace is somewhat narrower and longer. Fig. 4 shows the tail of a male caught on Eilanti (Surinam); it has a length of 38 cm (Schulz, 1968). The tail of the male is very muscular and tipped with a horny nail (Fig. 5). Stebbins (1966) mentions that males have a prehensile tail. In their paper on the behaviour of green turtles in the sea, Booth and Peters (1972) print a number of photos clearing up mating behavior. Some of the photos show that during mating the male's tail is curled around the backside of the female's body (her hind flippers ?), to give him a firmer grip.

Fig. 4. The tail of a male *Chelonia mydas*.

Fig. 5. The male's tail is tipped with horny nail.

SIZE AND WEIGHT

While the shell of a large green turtle may be almost 4 ft (120 cm) in length, 3 ft (90 cm) is nearer the average for an adult; a turtle was once taken at Key West (Florida) weighing 700 lbs (315 kg). Those appearing in the American markets today range from 75 lbs (33.5 kg) to 150 lbs (67.5 kg) (Loveridge, 1946). In Surinam the carapace length ranges from about 40 in (100 cm) to 50 in (125 cm) (Schulz, 1968). Deraniyagala (1953) mentions curved carapace lengths of about 48 in (122 cm), which are not uncommon at Sri Lanka. Pritchard (1971) gives the following carapace lengths of mature females: Galapagos Islands from 28.5 in (72 cm) to 37 in (94 cm), Surinam 39 in (99 cm) to 48 in (122 cm), Ascension Island 33 in (84 cm) to 55 in (140 cm), in Guyana from 38 in (96.5 cm) to 46 in (117 cm), and in Costa Rica from 35 in (89 cm) to 44 in (112 cm). Two adult males in the Galapagos had carapace lengths of 31.5 in (80.0 cm) and 33.2 in (84.3 cm).

Worrell (1963) mentions a maximum weight of about 850 lbs (382 kg) for Australia, but the results of turtle-hunters indicates that specimens over about 250 lbs (112.5 kg) are quite rare. In November 1952 a green turtle was stranded on the Dutch coast, which is very uncommon for temperate areas; the carapace was only 14 in (36 cm) long and 11.5 in (29.5 cm) wide (Brongersma, 1961). Undoubtedly, it was a juvenile. Hirth and Carr (1970) give some sizes of green turtles caught on the feeding pastures near Khor Umaira, southern Yemen; the carapace lengths of 178 females ranged from 29 in (48.3 cm) to 44 in (111.8 cm) - average 34.7 in (88.1 cm). The carapace lengths of 112 males ranged from 28 in (71.1 cm) to 41 in (104.1 cm) - average 35.6 in (90.4 cm).

The heaviest green turtle ever reported, weighed 860 lbs (386 kg). Almost half of the wet weight of a green turtle represents edible protein (Hirth, 1971).

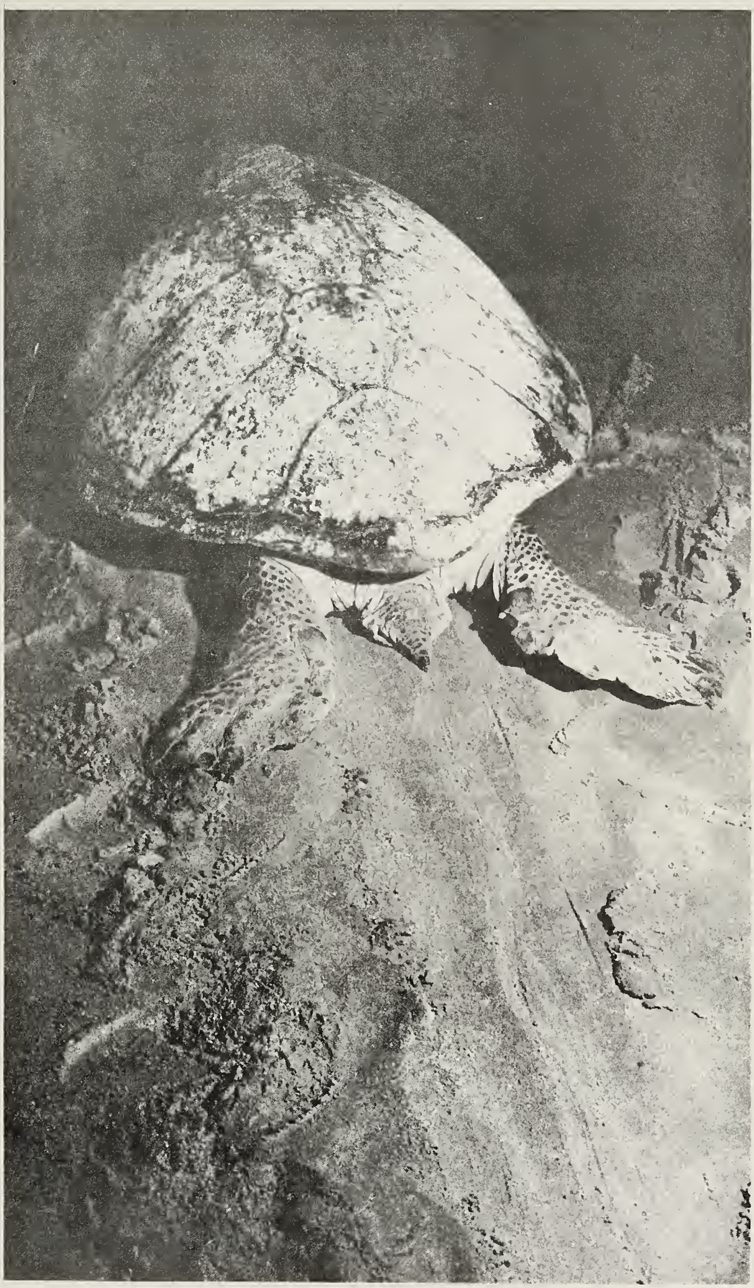

Fig. 6. Female *C. mydas* crawling up on a beach.

COLOR

There is a considerable variation in color, as previously mentioned. Therefore, for purposes of identification a color description of the turtle will never be enough. In his synopsis on the green turtle, Hirth (1971) gives the following description of the coloration of the various subspecies:

Chelonia m. mydas has a predominately brownish carapace, sometimes with olive or dark brown blotches and streaks. The dorsal surfaces of the head, flippers and tail are also predominatly brownish.

C. m. agassizii has a basically greenish or olive-brown carapace sometimes strongly flecked with black.

C. m. carrinegra is characterized by black pigmentation on both dorsal and ventral surfaces (plastron more greyish).

C. m. japonica (from Philippines waters) is rusty reddish brown above, each shield streaked with amber, head shields distinctly reddish and each edged with black, plastron yellow. Around Thailand waters this subspecies is greenish to greyish above, specimens with dark rays are observed as well; the plastron is yellow.

In the Galapagos two color forms exist, a pale (called 'yellow' turtle) and a dark form. The latter nests on several islands, but the yellow has never been seen nesting there. In both forms the plastron always has variable grey areas on the sides and along the midline. According to Pritchard (1971) both forms belong to the subspecies *C. agassizii*.

These are only a few of the number of green turtle "forms" existing. It appears that coloration is highly variable. Besides, there also seems to be color differences between males and females. In a few cases this has been indisputable ascertained. Not only in the Atlantic Ocean and Mediterranean, but also throughout the Pacific Ocean and the Indian Ocean and the Indian Ocean an unknown number of races exist. Careful research (as soon as possible) will indicate into how many races (separate species ?) *Chelonia mydas* can be divided. It is possible, that some races will become extinct in the near future, if no protective measures are taken. Efforts should be made so that each race survives.

FOOD

It can be stated that adult and sub-adult green turtles are mainly herbivorous, while the young (1 to 2 years old) are carnivorous (Schulz, 1968). The main diet of adults consists of sea grasses, the so called "turtle grass", that grow in sheltered shallow water. Submarine pastures near coastal areas and on atolls are visited by the turtles at selected places throughout the year. The stomach contents of over 100 turtles, caught near Khor Umaira (Southern Yemen), were examined and it appeared that two types of turtle grass, *Posidonia sp.* and *Halodule sp.*, form the menu. Also a small amount of brown algae and red algae were found (Hirth and Carr, 1970). The stomach of 6 mature turtles (5 ♀, 1♂) packed solidly with this grass, weighed between 3.9 lbs (1.8 kg) and 5.5 lbs (2.5 kg). The densities of turtle grass (*Posidonia*) reach 2500 leaves per square

Fig. 7. Female *C. mydas* digging body pit.

meter at Southern Yemen. The distribution of green turtles coincides with the distribution of sea grasses (Hirth, 1971). Offshore of Surinam there is no turtle grass growing, and the number of reptiles existing there is limited and is restricted to mostly juveniles. In the Galapagos *Caulerpa* is eaten. Stomachs of turtles also contain mangrove leaves and roots (Pritchard, 1971). Turtles from the Atlantic coast of Mexico and from the West Indies had eaten in large quantities the turtle grass *Thalassia*. Other vegetable rests taken from stomachs appeared to belong to the genera *Zostera* (e.g. Bermuda and Chile), *Sargassum* (e.g. Pacific coast of Mexico), *Sagittaria, Vallisneria* (e.g. Florida), *Cymodocea, Ulva, Halophila* and others. Adults and sub-adults are not averse to eating animals as well. Some animals may be devoured accidentily together with the swallowing of marine plants. There is a possibility that specimens traveling over long distances from feeding grounds to breeding grounds and back, have to eat animals (e.g. jellyfish) due to a lack of seaweeds. Other marine animals found in turtle stomachs are: sponges, molluscs (e.g. snails) and crustaceans (e.g. crabs). In captivity green turtles can survive on a diet of mixed fishes. Young turtles eat almost any animal they can devour (Burton, 1970). That is not amazing since the species' favorite seagrasses are absent off the nesting beaches.

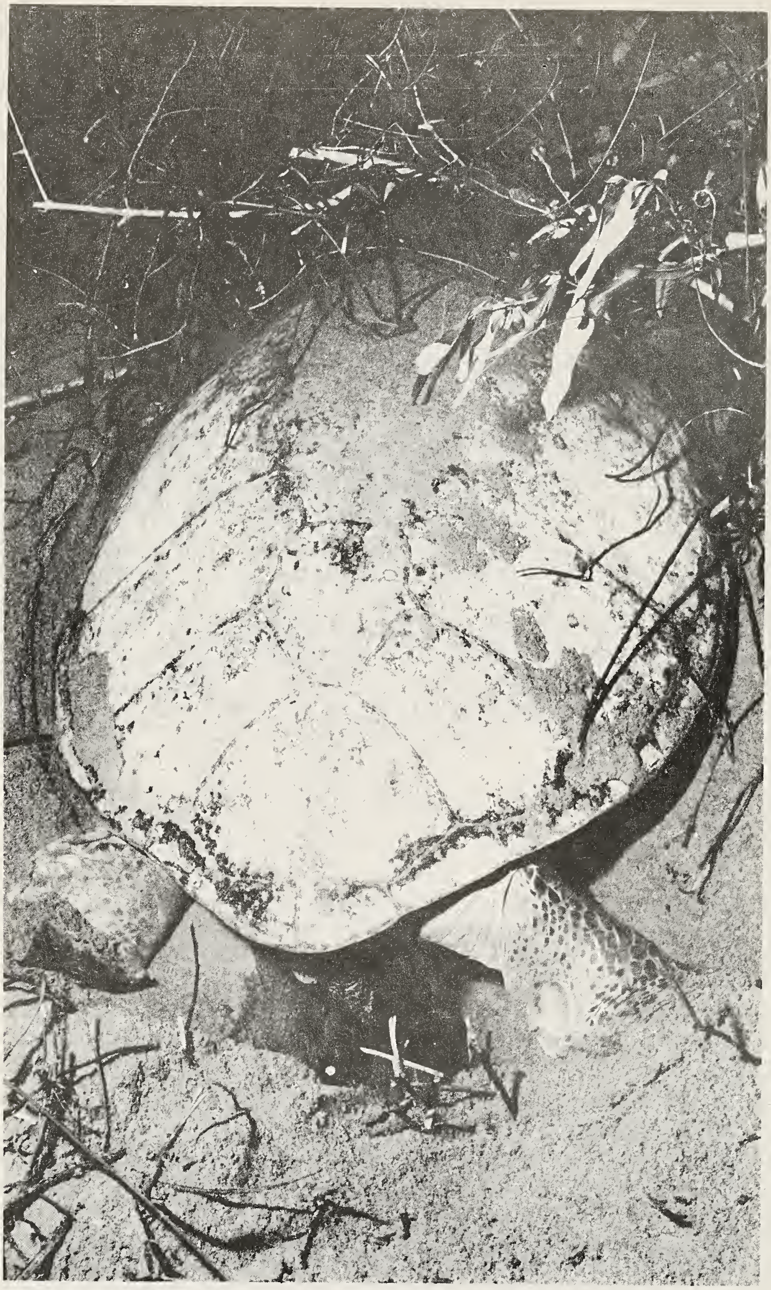

Fig. 8. Female *C. mydas* digging nest hole.

NESTING, EGGS, HATCHLINGS

Females come ashore to lay eggs on or around the night high tide (Fig. 6). After reaching the beach, the turtle reposes for a while. Possibly to orientate and to examine if the coast is clear; moreover, she presses the head on the sand (Janssen, 1972). The function of this "sand-smelling" is still unknown. She then crawls from surf to the nest site and progresses by laborious forward thrusts in which all four limbs move at once (Bustard, 1968). This is extremely exhausting for the turtle, because of the soft sand. The animals are very shy at this time and will return to the sea immediately upon disturbance (i.e. lights, approaching of people, talking).

After clearing the nest site (preferably a beach platform well above flood tide; Hirth, 1971) a body pit is excavated (Fig. 7). With all four limbs sand is thrown backwards, while the plastron rests on the sand. Occasionally the animal moves forward until a pit is produced somewhat larger than the turtle's body (Schulz, 1968). The depth of the body pit varies from 12 to 20 in (30 to 50 cm). During digging the animal rests repeatedly. After completion of the body pit, she starts excavating the nest hole (Fig. 8). She scoops out the sand beneath the cloaca with her hind flippers and puts it beside the nest. She continues scooping till the nest hole has a depth of about 20 in (50 cm) and a diameter of about 12 in (30 cm)(Somberg-Honig, 1967). If during excavating an obstacle is met (e.g. stone or stub), the whole process is repeated at an other site near by.

The eggs are white and usually dropped one, two or three at a time. The spherical eggs are covered with mucous when leaving the cloaca (Fig. 10)(Hirth, 1971). Egg laying takes about 8 to 12 minutes (Schulz, 1968). Frauca (1973) however, states that this takes 30 minutes to over one hour (Fig. 9). The eggs weigh between 28 and 44 gms each and have a diameter from 40 to 55 mm. Nests contain between 50 and 200 eggs (Frauca, 1970), 48 - 131 (Pritchard, 1971), 70 - 130 (Hirth and Carr, 1970), 137 on an average (Schulz, 1968). Pritchard (1969) reports the average number of eggs per nest at Surinam as 142.8, at Tortuguero 110.0, at Ascension 115.5, and at Sarawak 104.7.

The female covers both the nest hole and body pit with sand and makes her way back at sea (where the males are waiting), leaving behind deep tracks on the sandy beach (Fig. 11). During nesting and covering she may move one ton of sand (Frauca, 1970). The female green turtle spends about 3 hours out of the water when nesting and laying, but this varies and depends on beach conditions. Most green turtles lay between 3 and 7 times each season at about 10 to 16 day intervals (Hirth, 1971). Incubation takes about 7 to 10 weeks, but this depends mainly on climate, season and temperature. In Australia (Heron Island) it takes about 8 to 9 weeks (Bustard, 1968), but at Tortuguero 7 to 10 weeks. Hirth and Carr (1970) mention 48 - 49 days at Abul Wadi Beach (Aden).

Emergence from the sand normally takes place under cover of darkness when predation hazard is greatly reduced. Carapace length of hatchlings varies from 44 to 56 mm. Balazs and Ross (1973), give mean values of 125 one-day-old turtles at the Hawaii Institute of Marine Biology: weight 0.029 kg, carapace length 50 mm, carapace width 36 mm. The movement from

the nest to the surface of the sand is a process that repeats that described for the leatherback, *Dermochelys coriacea* (Zwinenberg, 1974). The carapace of hatchlings is extremely dark (black to dark greenish or dark brownish - Fig. 12). After emergence, the young head for the light horizon (the sea), rush into the sea and swim rapidly to deeper waters. Little is known about the habits of the hatchlings after entering the sea.

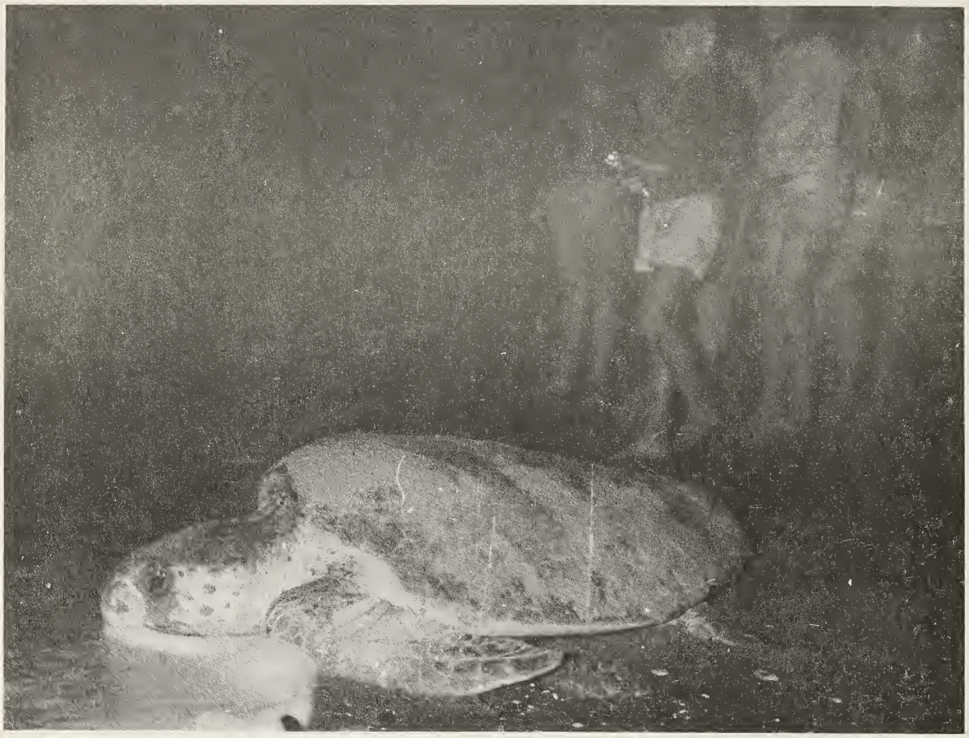

Fig. 11. A large crowd gathers as the female heads back to sea.

ENEMIES AND TURTLE FARMING

Eggs are dug out and eaten by dogs, foxes, pigs, crabs, rats, monitor lizards and sometimes birds in addition to man. The mortality of hatchlings is high. Approximately less than 1% of them survive to adulthood. Newly hatched turtles have soft shells and are killed by a wide range of predators before they can reach the sea, e.g. by ghost crabs (*Ocypode sp.*), dogs, foxes, raccoons, feral cats, frigate birds (when emergence incidentally takes place at daylight), night herons, rats, mongooses, tigers, jaguars, crows, silver gulls (*Larus novae-hollandiae*), monitor lizards (*Varanus sp.*), snakes (*Python sp.*). The few that reach the sea are largely eaten by large fishes, crocodiles and in large numbers by sharks. The stomach of a black-tipped reef shark killed off Australia's coast contained 14 hatchlings (Bustard, 1973).

Adults are killed by sharks too. Many specimens caught at sea or observed on beaches show damages of shark attacks. Except for sharks,

adult green turtles have hardly any natural predators. Only man forms a threat. Mortality is high, as mentioned earlier. Protection is badly needed for obvious reasons. Hatchlings should have a chance to reach adulthood. Green turtle hatcheries operate at different places in the tropical world to help assure their survival. Bustard (1968) collected 30,000 green turtle eggs annually (at a later stage 50,000) from Heron Island for incubation elsewhere under control. After emergence the young are kept in pools for some time [Carr and Ingle (see Peters, 1968) proposed they be kept until they reach shell lenghts of 6 - 8 in (15 - 20 cm)], tagged and released at sea in several areas. Hatchlings (more than 100,000) are flown from Caribbean beaches (especially from Tortuguero, Costa Rica) to Florida, South America and many other areas for release in hopes to replenishing turtle stocks. In 1968 the Queensland Government gave 5 species of sea turtle full protection, including the green turtle (Bustard, 1969). Full protection for green turtles and their eggs are given at Ascension Island, in Costa Rica, Surinam and Panama. In other areas turtles and eggs are protected only for a number of months, as in Trinidad (from 1 June - 30 September) and French Guiana (from 1 May - 31 August). Green turtles cannot be hunted except under licences, which are hardly ever given, at Sabah, Malaysia (De Silva, 1969). Mexico gives full protection for eggs and allows hunting of turtles during open season. I agree with Hirth (1971), who states that the best and simplest method to secure the green turtle's future is to provide protection for nesting females, eggs, and hatchlings on the natural rookeries, so survival is assured.

Fig. 12. A young green turtle with egg-tooth.

CONCLUSION

The green turtle is one of the most studied species of sea turtle. We know more about its life history, then of any other sea turtle, and still a number of facts are unknown or need further study. For instance, little is known of the seasonal trips the turtles make between feeding grounds and nesting beaches. Navigation and orientation should be studied continously, as well as the migration routes. Tagged females from Tortuguero rookeries were recaptured 2400 km away. Others were taken at a distance of 800 km in another direction. Most of these turtles, however, return to the same nesting ground within 2 - 4 years. How do they manage? Hirth and Carr (1970) tagged some females in southern Yemen, five were later taken off the coast of Somalia. One of them had covered a distance of about 3200 km in exactly 2 years. Ascension Island turtles were recaptures off the coast of Brazil (over 2200 km) and the shores of the Ivory Coast (Africa), about 1600 km away (Fig. 13). Not all turtles travel

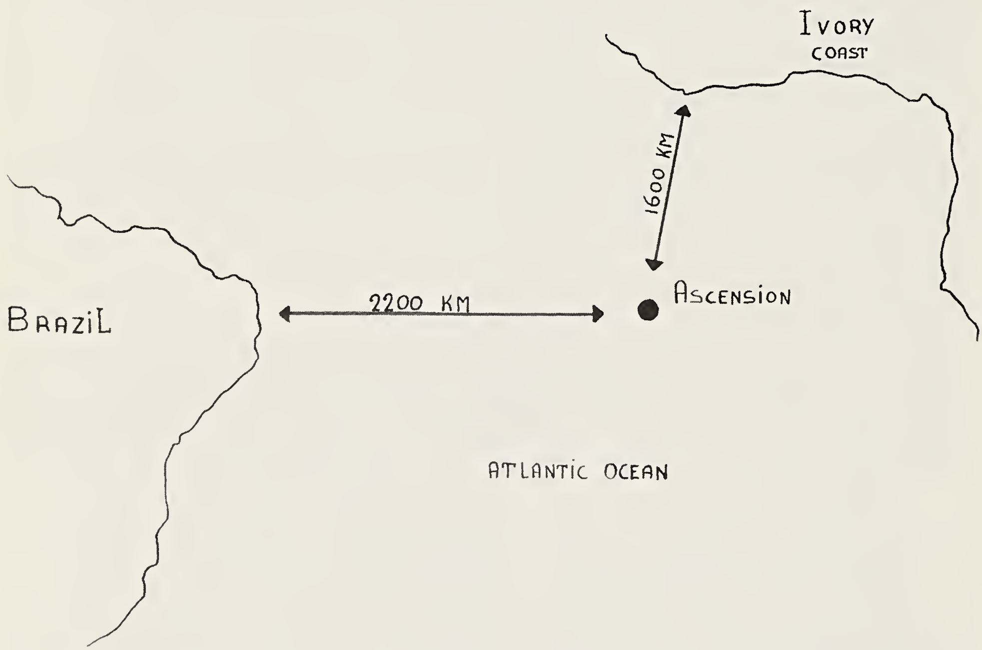

Fig. 13. The migration of green turtles from Ascension Island.

over great distances. A lot are taken within a radius of 100 km of the beach where they were tagged.

We know hardly anything of the hatchlings after they reach the sea. Females do come on beaches after reaching maturity, but males apparently never come ashore, except for some Pacific green turtles (*Chelonia m. agassizii*). In this subspecies it is known that males do occasionally bask on remote rockery beaches. The life span of *C. mydas* is still unknown. The feeding habits are also unclear. These, and a lot of other questions exist, making it clear that research must be continued. The

main concern now, is the immediate protection of *Chelonia mydas*, so that there will be enough time to permit all the necessary investigations, and so that the future of this valuable sea turtle will be ensured.

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Notes on a Brood of the Arizona Ridge-nosed Rattlesnake *Crotalus willardi willardi*

The limited number of natural history data and field observations of the ridge-nosed rattlesnake (*Crotalus willardi*) are indicated by the brief treatment given the species in Klauber's monographic review of the genus (1972). Other publications on the natural history of this species are few and brief in context.

On 3 August 1974, I captured an adult female Arizona ridge-nosed rattlesnake (*Crotalus willardi willardi*) at ca. 6500 ft elevation in the Santa Rita Mountains, Santa Cruz County, Arizona. The specimen appeared gravid and was collected with the hope of gathering reproductive data on the species. It was housed in a 2½ gallon aquarium and kept at room temperature, between 23 and 30° C. Fifteen days after capture 18 August, it gave birth to six live offspring and one stillborn which remained enclosed in the embryonic membranes. When I first observed the brood, about 24 hours after birth, the young were coated with dried membrane material from the egg. They were then soaked for several hours in water to remove the dried material. They were weighed on a Torsion Balance about 36 hours after birth and measured after their first molt between 24-29 August. Total lengths, weights and notes regarding food habits of the six offspring and the mother are presented in Table 1.

The coloration of the juveniles differed from that of the mother, who conformed to the general color description of the subspecies (Klauber, 1949). All of the young were distinctly grey and had bright yellow tails, not evident in the mother. The yellow tails faded after the second shed. The basic dorsal pattern of the mother was, however, apparent in the offspring.

Klauber (1949) noted a female *Crotalus w. willardi* that "contained 6 eggs" and a *Crotalus w. silus* that "contained at least 2 well-developed embryos." He also noted the measurements of three juvenile specimens captured in the wild and concluded that they represented the approximate size of the species at birth.

vi This account, however, appears to be the first confirmation of ovoviviparity in this species.

The mother and four of the offspring were released near the collection site on 1 September 1974. Two of the young were retained in captivity for further observations on growth and food intake, and to note their color changes during maturity.

Table 1. Total lengths and weights of a mother and six newborn *Crotalus willardi willardi* with notes on feeding and shedding between 18 August and 1 September.

	Approximate length (nearest 5 mm)	Weight (gms)	Feeding-shedding notes
Mother:	530	65.2 (after parturition)	Killed several small mice but refused to eat them before giving birth. Ate 6 small mice between 18 Aug. and 1 Sept.
Young:	180	5.43	Shed 29 Aug. Refused newborn mice.
	190	5.91	Shed 27 Aug. Refused newborn mice.
	190	6.04	Shed 25 Aug. Ate 1 newborn mouse.
	190	6.06	Shed 25 Aug. Ate 2 newborn mice.
	190	6.39	Shed 25 Aug. Ate 2 newborn mice.
	195	6.66	Shed 24 Aug. Ate 2 newborn mice.

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—Brent E. Martin, *704 N. Second Avenue, Tucson, Arizona 85705.*

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An Occurrence of the Arizona Ridge-nosed Rattlesnake, *Crotalus willardi willardi*, Observed Feeding in Nature

There are several indirect observations on the feeding habits of the ridge-nosed rattlesnake, *Crotalus willardi*, in nature. The following variety of food items have been found in the stomachs of dissected individuals: Van Denburgh (1922) and Klauber (1949) reported finding mammal remains, including small rodents. Klauber (1972) noted lizards (*Sceloporus sp., Gerrhonotus kingi*) and a bird, Wilson's Warbler (*Wilsona pusilla*). He also reported a scorpion disgorged by a *Crotalus w. willardi* in the possession of A. E. Ball. Fowlie (1965) captured an individual of this subspecies that disgorged a centipede several days later. Vorhies (1948), Manion (1968) and Harris (1975) mention lizards as the principal natural food of *Crotalus willardi*, but do not site direct feeding observations. Actual observations of this species feeding in the wild are unknown in the literature.

On the morning of 4 August 1974, I came upon a dead deer mouse (*Peromyscus sp.*) on the ground on an open oak-covered hillside at ca. 6500 ft elevation in the Santa Rita Mountains. Death appeared to have been recent, although the rodent was cold and somewhat stiff. No external injuries were apparent. Suddenly, I was startled by the rattling of an adult *Crotalus w. willardi* no more than two feet away from the mouse and myself. I was completely unaware of its presence until it rattled. As it turned to escape, I captured the snake, which then turned and bit my gloved hand several times. I then released it and after coiling up and continuously rattling for several moments it became quiet and slowly uncoiled, while flicking its tounge and stretching its jaws that were previously displaced from biting. It located the mouse, and began to ingest the rodent's head. When it was halfway down it noticed me move slightly from where I was sitting several feet away; it started to rattle and promptly regurgitated the mouse. When I moved about ten feet away, it stopped rattling and returned to its meal. After eventually swallowing the mouse, it slowly crawled towards a large fallen tree nearby, pausing frequently for several minutes. It then crawled over the tree and coiled up under a space between the fallen trunk and the ground.

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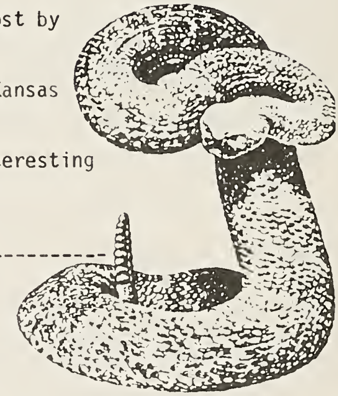

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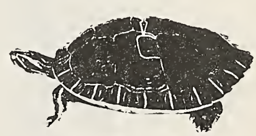

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The Maryland Herpetological Society
Department of Herpetology
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THE NATURAL HISTORY SOCIETY OF MARYLAND, INC.

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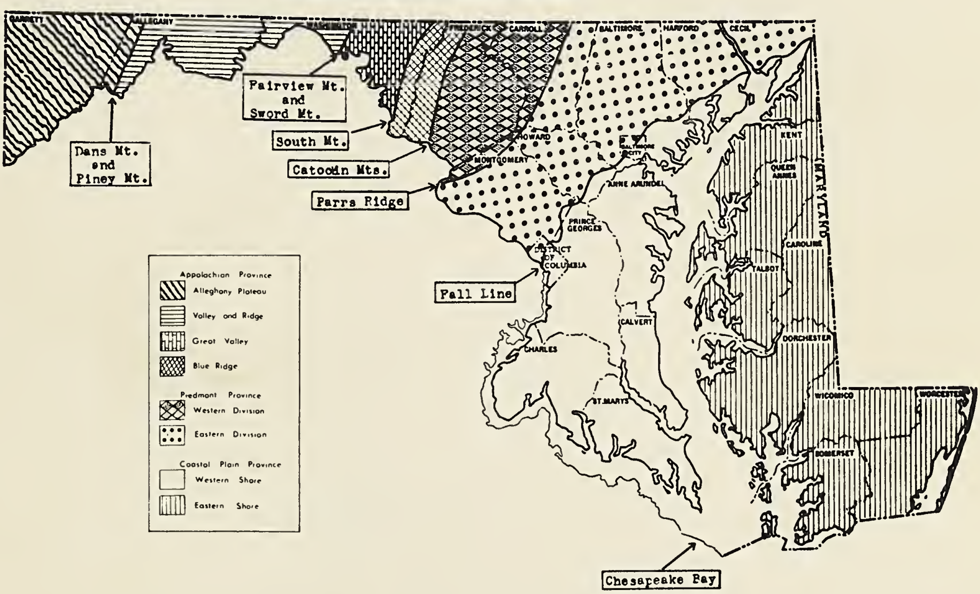

DISTRIBUTIONAL SURVEY (AMPHIBIA/REPTILIA): MARYLAND AND THE DISTRICT OF COLUMBIA

HERBERT S. HARRIS, JR.

MDHS.......A FOUNDER MEMBER OF THE
EASTERN SEABOARD HERPETOLOGICAL LEAGUE

SEPTEMBER 1975 VOLUME 11, NUMBER 3

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Volume 11 Number 3 September 1975

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Errata - *Bull. Md. Herp. Soc. 11* (3): 73-170

Page 77, line 6: (1960) should read (1970)
Map 37.(16)., line 5: *pipens* should read *pipiens*
61.(14)., lines 3, 9: *L. d. temporalis* should read *L. t. temporalis*
62.(15)., line 2: *L. d. triangulum* should read *L. t. triangulum*
64.(17)., line 4: (Cooper, 1970) should read (Cooper, 1969)
66.(19)., line 1: thru should read through
76.(2).: should read .... Eastern and Western Piedmont, and Blue Ridge Province via .....
88.(14).: Add (Feral) under *Chrysemys* (as in Map 87.(13).)

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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

VOLUME 11 30 SEPTEMBER 1975 NUMBER 3

DISTRIBUTIONAL SURVEY (AMPHIBIA/REPTILIA): MARYLAND AND THE DISTRICT OF COLUMBIA

by

Herbert S. Harris, Jr.*

Historically, few reports have dealt with the distribution of amphibians and reptiles in the State of Maryland and the District of Columbia. Kelly, Davis and Robertson's (1936) book on the snakes of Maryland, while beautifully illustrated, contained many errors on snake distribution. McCauley's (1945) momentous work on the reptiles of Maryland and the District of Columbia, containing species distribution maps, set an example not excelled to date. Mansueti (1949) produced in mimeograph form, keys to the sea turtles, and the adult frogs, toads and salamanders of this region. McCauley (1949) using this same medium, prepared a key to the adult snakes, lizards and turtles of Maryland and the District of Columbia. Unfortunately, these mimeographed keys did not get wide circulation and are unavailable. Stine (ca. 1953) prepared a mimeographed report on the physiographic distribution of the herpetofauna of Maryland, and in 1960, Cooper published the first report on the combined physiographic and county distribution of amphibians and reptiles of Maryland and the District of Columbia.

Cooper's (1960) paper was reprinted and revised by Harris (Cooper, 1965) in November 1965. Harris (1966-1969) published additions to this survey and in 1969, published a Distributional Survey of the region, providing spot distribution maps for every amphibian and reptile.

Numerous other publications exist, but concern only a limited region of the state, or a particular species or group of species. Many handbooks and field guides have been published which include Maryland, but are not limited to the state.

Maryland, including the District of Columbia, is bounded on the north by Pennsylvania, on the east by Delaware and the Atlantic Ocean, on the south by the Potomac River (West Virginia, Virginia) and on the west by West Virginia. From sea level (Atlantic Ocean) the topography rises to 3,340 feet (Backbone Mountain). The total area of the state is 12,327 square miles, of which 2,386 square miles are water.

* Curator, Department of Herpetology, Natural History Society of Maryland

The state is divided into three major physiographic provinces with eight recognizable divisions (Figure 1):

APPALACHIAN PROVINCE

1. Alleghany Plateau
2. Valley and Ridge
3. Great Valley
4. Blue Ridge

PIEDMONT PROVINCE

5. Western Division
6. Eastern Division

COASTAL PLAIN PROVINCE

7. Western Shore
8. Eastern Shore

The Fall Line (Figure 1), which separates the Coastal Plain from the Piedmont, is an important limiting factor in local distribution. Likewise, many of the other physiographic boundaries of the eight divisions produce potential distributional barriers to amphibians and reptiles.

On some of the distribution maps, expected ranges will be represented by shaded areas. The use of physiographic boundaries as distributional barriers and as boundaries to separate subspecies is conditional. Where the distributions of different subspecies contact, the zone of intergradation is usually broad and a single boundary line cannot be accurately used to show the area of intergradation. They are used here for convenience, and although not entirely accurate, will suffice to illustrate the general trend in distribution until a comprehensive study of each subspecies can be made.

Maryland can also be divided into Life Zones (Cope, 1873; Merriam, 1898) which have been used to explain amphibian and reptile distribution in the state (Cope, 1875, 1896, 1900). The Life Zones or "faunal areas" generally recognized consist of the Canadian Zone, The Alleghanian Fauna, and the Carolinian Fauna (Figure 2). The Canadian element is restricted to the higher elevations in Garrett County, and comprises little territory. The Alleghanian Fauna, occupies all of Maryland west of the Fall Line, and the Carolinian Fauna, all of the state east of the Fall Line. The Life Zones although useful, are not as indicative of amphibian and reptile distributions in Maryland, as are the Physiographic Provinces and hence, are not used here.

River valleys can affect distributions of animals by acting both as dispersal routes and as barriers. In a number of Coastal Plain species, isolated records exist in the Piedmont Province or Appalachian Province along the Potomac River. Lowland river valleys are "extensions" of the Coastal Plain as far as distributional expansion is concerned and have been and are being colonized by some species. The Potomac River and in modern times the C & O Canal both probably have acted as dispersal routes for distributional expansion. Likewise, many other rivers crossing physio-

graphic boundaries act as dispersal routes (See figure 3 for Drainage Basins).

Certain species considered Piedmont in distribution, sometimes occur as relict populations in the Coastal Plain Province. Again, rivers are usually the dispersal routes, either through normal animal migration or by individuals being "washed" downstream during severe storms. When species unwillingly enter "new" habitat the species may live out their life spans, die prematurely, or in some instances, adapt and colonize the new area and thus "expand" the species range.

Rivers and river valleys also act as barriers to amphibian and reptile dispersal. The salamanders *Eurycea l. guttolineata* and *Desmognathus m. jeffersoni*, both, have been dilgently searched for in Maryland, but the Potomac River is probably a barrier to these subspecies. The Potomac River is also a probable barrier to the lizard *Eumeces inexpectatus*.

Zoogeography is not stable. Animal distributions are changing due to fluxuations in climate and urbanization. Many of the localities indicated on the maps no longer support the listed species. Urbanization has virituely destroyed many habitats and thus altered animal distribution. Examples of these include the timber rattlesnake in Baltimore County, the narrow-mouthed toad at Cove Point, and the tiger salamander at LaPlata. Man's ever increasing need for land will continue to alter animal distributions worldwide. This in combination with the overcollecting of some species has recently brought about legislation to protect rare and endangered species.

Climatic changes come slowly and are not as obvious as changes caused by man. Climatic changes can best be explained by looking at past distributions of plant and animal communities. This must be done based on fossil evidence, and a knowledge of the paleogeography of the region under consideration. Even since the Miocene, North America has experienced many climatic and topographic changes. In order to explain current distributions, we need look only at the events that occurred during the last epoch, the Pleistocene.

Not only are current distributions explained by Pleistocene events, but sometimes relationships of related species can be more fully understood. *Pseudacris triseriata kalmi* of the Delmarva Peninsula is a distinctive animal and very different from *P. t. feriarum*. It appears closer related taxonomically to *P. t. triseriata* which today is found to the west of the range of *P. t. feriarum*. The paleogeography of this region, according to Smith (1957), indicates that a Prairie Peninsula during the Post-Wisconsin Glacial period reached the Atlantic Coast and that the entire Delmarva Peninsula consisted of prairie habitat. During this time, *P. t. triseriata* probably moved with the advancing prairies bisecting the distribution of *P. t. feriarum* and occupied the Delmarva Peninsula. With the retreat of the prairies, relict populations of *P. t. triseriata* remained with relict prairie habitat and differentiated into the subspecies *P. t. kalmi*. The bisected range of the subspecies *P. t. feriarum* rejoined with the retreat of the Prairie Peninsula and re-occupied the territory between the existing distributions of *P. t. triseriata* and *P. t. kalmi*.

In this vain, when additional specimens of *Lampropeltis triangulum* from the lower Delmarva become available they should be examined to determine if their affinity is with *L. t. syspilla* or *L. t. temporalis.*

Many distributions of Maryland amphibians and reptiles are unexplained, such as *Pseudotriton ruber ruber* and *Ambystoma maculatum.* Why do these species apparently not inhabit the Coastal Plain Province of the lower Delmarva Peninsula? The Susquehana River at one time during the Pleistocene apparently bisected the lower Delmarva Peninsula (Burns, 1973). Could this have happened prior to their distributional expansion and possibly explain the current zoogeography of these species? Several species apparently do not inhabit the central section of the Delmarva Peninsula. Could the Pleistocene route of the Susquehana River also possibly explain this hiatus in distribution? These and many other questions (Harris, et. al., 1967) are still to be answered, and when explanations are available will enable us to better understand current distributional patterns.

On the annotations accompanying the distribution maps, the breeding season (amphibians) and a brief habitat description (if restrictive) may be given. These data will enable the researcher to learn "when" and "where" to look for additional localities or range extensions. It is easier to examine ponds and streams for eggs or larvae of some species of amphibians than it is to collect adult specimens. If the habitat is restrictive such as with *Aneides* (Pottsville Sandstone outcroppings) and *Pseudotriton m. montanus* (Spring seepage areas) the "where" to look is also much reduced.

County records unsubstantiated by specimens in a recognized collection and doubtful literature records have not been included in the tables of county and physiographic distribution (tables 1-4). These records are indicated with circles (O) on the distribution maps. Specimens examined, and unquestionable literature records are represented on these maps by solid circles (●) (figure 4). For the purpose of this report, Baltimore City is considered to be part of Baltimore County.

A survey of this magnitude cannot be accomplished without the willing help of many people. I am extremely grateful and indebted to the following persons who have contributed data contained herein:

Don Boyer, Tom Boyer, Glenn Burns, Howard W. Campbell, Daniel Carver, Joseph Collins, Roger Conant, John E. Cooper, John Crenshaw, Rick Czarnowsky, James A. Fowler, L. Richard Franz, John Funk, William Grogan, Frank Groves, John Groves, Richard Hahn, Jerry D. Hardy, Richard Highton, David Hillis, George Jacobs, Jeremy Jacobs, David S. Lee, Brian Leverton, Daniel J. Lyons, William Marvel, Robert W. Miller, III, Kenneth T. Nemuras, Arnold Norden, Jack Norman, James A. Peters, Mark Prihoda, Clyde E. Prince, John A. Rahnis, Neil D. Richmond, Louis Rigley, Jack Ruppert, David Saui, Joseph Schuch, Frank J. Schwartz, William Shirey, Robert S. Simmons, George Stewart, Charles J. Stine, Jeff Thomas, Robert G. Tuck, Jr., Prescott Ward, Peter Wemple, Richard D. Worthington, Bill Zovickian.

A special note of thanks must also go to the following people who each have helped with the preparation of this manuscript. Geneva Ambrose has added the many additions to the bibliography as well as helped in the preparation of the tables and maps. Roger Conant reviewed the 1969 survey and forwarded many helpful suggestions and criticisms page by page. John E. Cooper's favorable review (1960) contained a few criticisms without merit, but on a whole was very helpful. Rick Czarnowsky prepared the table outlines and plotted some of the dots. My thanks also go to Robert Miller for the painstaking job of locating some of the new locality records on road maps for final plotting in the survey. Thanks are also due to Jerry D. Hardy, Jr. who read the final manuscript and made invaluable comments.

The Amphibians and Reptiles of Maryland and the District of Columbia

Caudata

1.(1). *Cryptobranchus alleganiensis alleganiensis*. Hellbender.
2.(2). *Necturus maculosus maculosus*. Mudpuppy.
3.(3). *Notophthalmus viridescens viridescens*. Red-spotted newt.
4.(4). *Ambystoma jeffersonianum*. Jefferson salamander.
5.(5). *Ambystoma maculatum*. Spotted salamander.
6.(6). *Ambystoma opacum*. Marbled salamander.
7.(7). *Ambystoma tigrinum tigrinum*. Eastern tiger salamander.
8.(8). *Aneides aeneus*. Green salamander.
9.(9). *Eurycea bislineata bislineata*. Northern two-lined salamander.
10.(10). *Eurycea longicauda longicauda*. Long-tailed salamander.
11.(11). *Hemidactylium scutatum*. Four-toed salamander.
12.(12). *Plethodon cinereus cinereus*. Red-backed salamander.
13.(13). *Plethodon hoffmani*. Valley and ridge salamander.
14.(14). *Plethodon glutinosus glutinosus*. Slimy salamander.
15.(15). *Gyrinophilus porphyriticus porphyriticus*. Northern spring salamander.
16.(16). *Pseudotriton montanus montanus*. Eastern mud salamander.
17.(17). *Pseudotriton ruber ruber*. Northern red salamander.
18.(18). *Desmognathus fuscus fuscus*. Northern dusky salamander.
19.(19). *Desmognathus ochrophaeus*. Mountain dusky salamander.
20.(20). *Desmognathus monticola monticola*. Appalachian seal salamander.
21.(21). *Siren lacertina*. Greater siren.

Salientia

22.(1). *Scaphiopus holbrooki holbrooki*. Eastern spadefoot.
23.(2). *Bufo americanus americanus*. American toad.
24.(3). *Bufo woodhousei fowleri*. Fowler's toad.

25.(4). *Acris crepitans crepitans.* Northern cricket frog.
26.(5). *Hyla cinerea.* Green treefrog. Upper Tidewater Potomac River populations, previously recognized as *Hyla cinerea evittata.*
27.(6). *Hyla crucifer crucifer.* Northern spring peeper.
28.(7). *Hyla versicolor.* Eastern gray treefrog.
29.(8). *Hyla chrysoscelis.* Southern gray treefrog.
30.(9). *Pseudacris triseriata feriarum.* Upland chorus frog.
31.(10). *Pseudacris triseriata kalmi.* New Jersey chorus frog.
32.(11). *Pseudacris brachyphona.* Mountain chorus frog.
33.(12). *Gastrophryne carolinensis.* Eastern narrow-mouthed toad.
34.(13). *Rana catesbeiana.* Bullfrog.
35.(14). *Rana virgatipes.* Carpenter frog.
36.(15). *Rana clamitans melanota.* Green frog.
37.(16). *Rana pipiens.* Northern leopard frog.
38.(17). *Rana utricularia utricularia.* Southern leopard frog.
39.(18). *Rana palustris.* Pickerel frog.
40.(19). *Rana sylvatica sylvatica.* Wood frog.

Squamata (Sauria)

41.(1). *Sceloporus undulatus hyacinthinus.* Northern fence lizard.
42.(2). *Cnemidophorus sexlineatus sexlineatus.* Six-lined racerunner.
43.(3). *Leiolopisma laterale.* Ground skink.
44.(4). *Eumeces anthracinus anthracinus.* Northern coal skink.
45.(5). *Eumeces fasciatus.* Five-lined skink.
46.(6). *Eumeces inexpectatus.* Southeastern five-lined skink (Tenative listing)
47.(7). *Eumeces laticeps.* Broad-headed skink.

Squamata (Serpentes)

48.(1). *Carphophis amoenus amoenus.* Eastern worm snake.
49.(2). *Farancia erytrogramma erytrogramma.* Rainbow snake.
50.(3). *Diadophis punctatus punctatus/edwardsi.* Intergrade population between southern and northern ringneck snakes on the Delmarva Coastal Plain.
51.(4). *Diadophis punctatus edwardsi.* Northern ringneck snake.
52.(5). *Heterodon platyrhinos.* Eastern hognose snake.
53.(6). *Opheodrys aestivus.* Rough green snake.
54.(7). *Opheodrys vernalis vernalis.* Eastern smooth green snake.
55.(8). *Coluber constrictor constrictor.* Northern black racer.
56.(9). *Elaphe obsoleta obsoleta.* Black rat snake.
57.(10). *Elaphe guttata guttata.* Corn snake.
58.(11). *Pituophis melanoleucus melanoleucus.* Northern Pine snake. (Tenative listing)
59.(12). *Lampropeltis getulus getulus.* Eastern kingsnake.
60.(13). *Lampropeltis calligaster rhombomaculata.* Mole snake.

61.(14). *Lampropeltis triangulum triangulum.* Eastern milk snake.
62.(15). *Lampropeltis triangulum temporalis.* Coastal plain milk snake.
63.(16). *Cemophora coccinea copei.* Northern scarlet snake.
64.(17). *Natrix erythrogaster erythrogaster.* Red-bellied water snake.
65.(18). *Natrix sipedon sipedon.* Northern water snake.
66.(19). *Natrix septemvittata.* Queen snake.
67.(20). *Storeria dekayi dekayi.* Northern brown snake.
68.(21). *Storeria occipitomaculata occipitomaculata.* Northern red-bellied snake.
69.(22). *Virginia valeriae valeriae.* Eastern earth snake.
70.(23). *Virginia valeriae pulchra.* Mountain earth snake.
71.(24). *Thamnophis sauritus sauritus.* Eastern ribbon snake.
72.(25). *Thamnophis sirtalis sirtalis.* Eastern garter snake.
73.(26). *Agkistrodon contortrix mokasen.* Northern copperhead. Southern Eastern Shore populations exhibit *A. c. contortrix* influences. Specimens from southern St. Mary's County also show some *A. c. contortrix* tendencies.
74.(27). *Crotalus horridus horridus.* Timber rattlesnake.

Chelonia

75.(1). *Sternotherus odoratus.* Stinkpot.
76.(2). *Kinosternon subrubrum subrubrum.* Eastern mud turtle.
77.(3). *Chelydra serpentina serpentina.* Common snapping turtle.
78.(4). *Clemmys guttata.* Spotted turtle.
79.(5). *Clemmys insculpta.* Wood turtle.
80.(6). *Clemmys muhlenbergi.* Bog turtle.
81.(7). *Terrapene carolina carolina.* Eastern box turtle.
82.(8). *Malaclemys terrapin terrapin.* Northern diamondback terrapin.
83.(9). *Graptemys geographica.* Map turtle.
84.(10). *Chrysemys picta picta.* Eastern painted turtle.
85.(11). *Chrysemys picta marginata.* Midland painted turtle.
86.(12). *Chrysemys rubriventris.* Red-bellied turtle.
87.(13). *Chrysemys scripta elegans.* Red-eared turtle. Feral.
88.(14). *Chrysemys scripta troosti.* Cumberland turtle. Feral.
89.(15). *Chelonia mydas mydas.* Atlantic green turtle.
90.(16). *Eretmochelys imbricata imbricata.* Atlantic hawksbill.
91.(17). *Caretta caretta caretta.* Atlantic loggerhead.
92.(18). *Lepidochelys kempi.* Atlantic ridley.
93.(19). *Dermochelys coriacea coriacea.* Atlantic leatherback.
94.(20). *Trionyx spiniferus spiniferus.* Eastern spiny softshell.

Doubtful or Erroneous Records and Possible Additions with a Comment on *Siren lacertina* and *Pituophis melanoleucus melanolecus*

I. In the past, the following species have appeared on checklists of Maryland herpetofauna. Some of these records are due to old and unsub-

stantiated accounts and misidentification; other occurrences are presently doubtful. I am, at this time, removing them until they can be proved part of the Maryland fauna:

Hyla femoralis - Reported from Calvert County, Maryland, by Fowler and Orton (1947) on the basis of four specimens collected at Battle Creek cypress swamp. Much doubt does exist (Fowler, 1969) as to whether or not this record is valid. Diligent searching has failed to produce additional specimens. Until the existence of *H. femoralis* in Maryland can be verified, it cannot be included in the state list. The nearest known locality is near Lanexa, New Kent County, Virginia.

Chrysemys floridana floridana - Upon examination, all available Maryland material previously assigned to this species has been re-identified as *C. rubriventris*. A specimen of *C. f. floridana* collected "20 miles from Baltimore" is considered a release. Nearest reliable records apparently are from North Carolina. All Virginia records, except for an "established" colony at Richmond are questionable (Tobey, 1975).

Chrysemys concinna concinna - Originally placed on the state list by Harris (Cooper, 1965) on the basis of two hatchlings collected in the Patapsco River at its intersection with the Baltimore-Washington Parkway. Since numerous attempts to locate additional specimens have been fruitless, it would be best to remove *C. c. concinna* until it can be proven to be native or established in Maryland. Nearest reliable records are from the James River, near Wingina, Va. and from the head of Washington Ditch, off Lake Drummond, Va. (Tobey, 1975).

II. Possible Additions

Plethodon wehrlei - Reliable records in Pennsylvania and West Virginia indicate that this salamander possibly exists in extreme western Garrett County. It should be searched for in talus slopes in the northwestern sector of Garrett County.

Eurycea longicauda guttolineata - Possibly occuring from the District of Columbia south into Prince George's County and into southern Maryland on the Western Shore, although the Potomac River is probably a barrier to this salamander. *E. l. guttolineata* has been collected within 500 feet of the Potomac River in a tributary of Difficult Creek, Virginia. *E. l. longicauda* has been collected within feet of the Potomac River at Great Falls, Maryland.

Desmognathus monticola jeffersoni - This salamander occurs in the Blue Ridge of Virginia, but the Potomac River (Harper's Ferry) produces a probable barrier to the northeast extension of its range into Maryland.

III. Comments

Siren lacertina - An old record for the Potomac Flats (Hay, 1902) is apparently valid. Recently, a specimen was found in a jar of preserved fishes, labeled "Battle Creek Cypress Swamp, Calvert County, Maryland" (Towson State Collection). A diligent search of this area has failed to produce an additional specimen. At this time it is uncertain that this salamander still exists in Maryland. *S. lacertina* has been observed and collected at Camp A. P. Hill, Caroline County, Virginia.

Pituophis melanoleucus melanoleucus - In the 1969 Survey, I said "The existing state records are doubtful and no specimens are available. The sporadic range of this snake apparently does not include Maryland."

MaCauley (1945) summarized the knowledge known at that time and listed the pine snake as possibly occurring in Maryland. Although no specimens were available, he accepted Dr. Truitt's record and also presented a verbal account given to him by the superintendent and personnel at a Civilian Conservation Corps Camp near Ocean City. The other records cited by MaCauley (1945) are open to question for many reasons and were unacceptable to him. There is no reason to doubt Dr. Truitt's record, except that the specimen is not available.

Grogan (1973) reported a specimen from Ft. Meade, Anne Arundel County, Maryland which is preserved in the USNM collection. However, this record can not be accepted as legimate as stated in the account on *P. m. melanoleucus* prepared by the Committee on Rare and Endangered Amphibians and Reptiles of Maryland (1973). Lee (1972) mentions a specimen of *Pituophis* observed by I. Hampe, swiming in Sinepuxent Bay. Grogan (1973) and Lee (1972) also mention "Bull Snakes" observed by Park Rangers in this area. I have had two contacts with people, in which, I was asked to identify the snake they described. In both cases, they described a large white snake with black blotches, and the sightings were in Wicomico and Worcester Counties respectfully. It is hard to understand that such a large and distinctive snake such as *Pituophis*, if it is indeed a legimate member of the Maryland herpetofauna, could have eluded herpetologists so long.

I would like to see a legimate Maryland specimen of *P. m. melanoleucus* before adding this species to the official list of Maryland herpetofauna, but have tenatively listed it on the basis of Dr. Truitt's record and the recent sightings.

AMPHIBIA	Allegany	Anne Arundel	Baltimore	Caroline	Carroll	Calvert	Cecil	Charles	Dist. of Columbia	Dorchester	Frederick	Garrett	Harford	Howard	Kent	Montgomery	Prince George's	Queen Anne's	Somerset	St. Mary's	Talbot	Washington	Wicomico	Worcester
C. a. alleganiensis							●					●	●											
N. m. maculosus												●												
N. v. viridescens	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			●	●	●		
A. jeffersonianum	●										●											●		
A. maculatum	●	●	●		●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●		
A. opacum	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
A. t. tigrinum		●		●				●		●					●			●	●					●
A. aeneus												●												
E. b. bislineata	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●	●	
E. l. longicauda	●		●		●		●				●	●	●	●		●						●		
H. scutatum	●	●	●	●		●	●	●	●	●		●	●	●	●	●	●			●	●	●	●	●
P. c. cinereus	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
P. hoffmani	●											●										●		
P. g. glutinosus	●		●		●		●				●	●	●	●		●						●		
G. p. porphyriticus	●										●	●										●		
P. m. montanus		●	●			●		●	●							●	●	●		●			●	●
P. r. ruber	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●		
D. f. fuscus	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●	●	
D. ochrophaeus	●											●												
D. m. monticola	●											●												
S. lacertina						?			●															
S. h. holbrooki		●		●		●		●	●	●	●				●		●		●	●	●		●	●
B. a. americanus	●	●	●		●	●	●	●	●		●	●	●	●		●	●		●			●	●	●
B. w. fowleri	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
A. c. crepitans	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
H. cinerea		●	●			●	●	●	●	●			●		●	●	●	●	●	●	●		●	●
H. c. crucifer	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
H. versicolor	●	●	●		●		●		●		●	●	●	●	●	●	●				?	●		
H. chrysoscelis		●		●		●	?	●		●					?		●		●	●	●		●	●
P. t. feriarum	●	●	●		●	●		●	●		●		●	●		●	●			●		●		
P. t. kalmi				●			●			●					●			●	●		●		●	●
P. brachyphona	●											●												
G. carolinensis						●				●									●	●				●
R. catesbeiana	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R. virgatipes										●													●	●
R. c. melanota	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R. pipiens	●		●		●						●	●	?									●		
R. u. ultricularia		●	●	●		●	●	●	●	●			●	●	●	●	●	●	●	●	●		●	●
R. palustris	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●
R. s. sylvatica	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●		●	●	●	●

Table 1. County Distribution of Maryland Amphibians

	APPALACHIAN PROVINCE				PIEDMONT PROVINCE		COASTAL PLAIN PROVINCE	
AMPHIBIA	Alleghany Plateau	Valley and Ridge	Great Valley	Blue Ridge	Western Division	Eastern Division	Western Shore (Inner Division)	Eastern Shore (Outer Division)
C. a. alleganiensis	●					●		
N. m. maculosus	●							
N. v. viridescens	●	●	●	●	●	●	●	●
A. jeffersonianum	●	●	?	●	●			
A. maculatum	●	●	●	●	●	●	●	●
A. opacum		●	●	●	●	●	●	●
A. t. tigrinum							●	●
A. aeneus	●							
E. b. bislineata	●	●	●	●	●	●	●	●
E. l. longicauda	●	●	●	●	●	●		
H. scutatum	●	●	●		●	●	●	●
P. c. cinereus	●	●	●	●	●	●	●	●
P. hoffmani	●	●						
P. g. glutinosus	●	●	●	●	●	●		
G. p. porphyriticus	●	●	●	●	●			
P. m. montanus						●	●	●
P. r. ruber	●	●	●	●	●	●	●	●
D. f. fuscus	●	●	●	●	●	●	●	●
D. ochrophaeus	●	●						
D. m. monticola	●	●						
S. lacertina							●	
S. h. holbrooki					●		●	●
B. a. americanus	●	●	●	●	●	●	●	●
B. w. fowleri	?	●	●	●	●	●	●	●
A. c. crepitans		●	●	●	●	●	●	●
H. cinerea						●	●	●
H. c. crucifer	●	●	●	●	●	●	●	●
H. versicolor	●	●		●	●	●	●	●
H. chrysoscelis							●	●
P. t. feriarum		●	●	●	●	●	●	
P. t. kalmi						?		●
P. brachyphona	●	●						
G. carolinensis							●	●
R. catesbeiana	●	●		●	●	●	●	●
R. virgatipes								●
R. c. melanota	●	●	●	●	●	●	●	●
R. pipiens	●	●	●	●	●	●		
R. u. ultricularia						●	●	●
R. palustris	●	●	●	●	●	●	●	●
R. s. sylvatica	●	●	●	●	●	●	●	●

Table 2. Distribution of Maryland Amphibians by Physiographic Provinces

REPTILIA	Allegany	Anne Arundel	Baltimore	Caroline	Carroll	Calvert	Cecil	Charles	Dist. of Columbia	Dorchester	Frederick	Garrett	Harford	Howard	Kent	Montgomery	Prince George's	Queen Anne's	Somerset	St. Mary's	Talbot	Washington	Wicomico	Worcester
S. u. hyacinthinus	●	●	●	●	●	●	●	●	●		●		●	●	●	●	●	●	●	●	●	●	●	●
C. s. sexlineatus	●	●	●			●		●	●		●						●			●				
L. laterale		●				●		●	●	●							●		●	●	?		●	●
E. a. anthracinus	●											●												
E. fasciatus	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
E. inexpectatus						?																		
E. laticeps		●	●			●	●	●		●	●					●	●	●	●	●	●	●	●	●
C. a. amoenus	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
F. e. erytrogramma								●																
D. p. punctatus/edwardsi				●			●			●					●			●	●		●			●
D. p. edwardsi	●	●	●		●	●	●	●	●		●	●	●	●		●	●			●		●		
H. platyrhinos	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
O. aestivus		●	●	●		●	●	●	●	●			●	●		●	●	●	●	●	●	●	●	●
O. v. vernalis	●										●	●										●		
C. c. constrictor	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
E. o. obsoleta	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
E. g. guttata	●	●		●		●		●	●	●						●	●		●	●	●	●	●	
P. m. melanoleucus																								?
L. g. getulus		●	●	●		●	●	●	●	●			●	●	●	●	●	●	●	●	●		●	●
L. c. rhombomaculata		●						●	●					●		●	●			●				
L. t. triangulum	●	●	●		●		●		●		●	●	●	●		●	●					●		
L. t. temporalis		●				●		●	●								●			●				●
C. c. copei		●	●			●			●								●						●	
N. e. erythrogaster										●													●	
N. s. sipedon	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
N. septemvittata	●	●	●		●	●	●		●		●	●	●	●	●	●	●					●		
S. d. dekayi	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
S. o. occipitomaculata	●	●	●			●	●	●	●		●	●		●				●	●	●		●	●	●
V. v. valeriae		●	●		●	●	●	●	●		●		●	●	●	●	●			●		●	●	●
V. v. pulchra												●												
T. s. sauritus	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
T. s. sirtalis	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●
A. c. mokasen	●	●	●		●	●	●	●	●	?	●	●	●	●		●	●		●	●		●	●	●
C. h. horridus	●		●								●	●										●		
S. odoratus	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
K. s. subrubrum		●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
C. s. serpentina	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
C. guttata	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
C. insculpta	●		●				●				●	●	●	?		●	●					●		
C. muhlenbergi			●		●		●						●											
T. c. carolina	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
M. t. terrapin		●	●			●		●	●	●			●		●			●	●	●	●		●	●
G. geographica							●						●											
C. p. picta	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
C. p. marginata	?											●												
C. rubriventris	●	●	●	●		●	●	●	●	●	●		●		●	●	●	●		●		●	●	●
C. m. mydas						●																		●
E. i. imbricata	Atlantic; no specific Maryland records																							
C. c. caretta						●				●					●						●			●
L. kempi			●			●																		
D. c. coriacea						●				●														
T. s. spiniferus												●												

FERAL

	Allegany	Anne Arundel	Baltimore	Caroline	Carroll	Calvert	Cecil	Charles	Dist. of Columbia	Dorchester	Frederick	Garrett	Harford	Howard	Kent	Montgomery	Prince George's	Queen Anne's	Somerset	St. Mary's	Talbot	Washington	Wicomico	Worcester
C. s. elegans		●	●								●		●			●	●					●		
C. s. troosti			●																					

Table 3. County Distribution of Maryland Reptiles

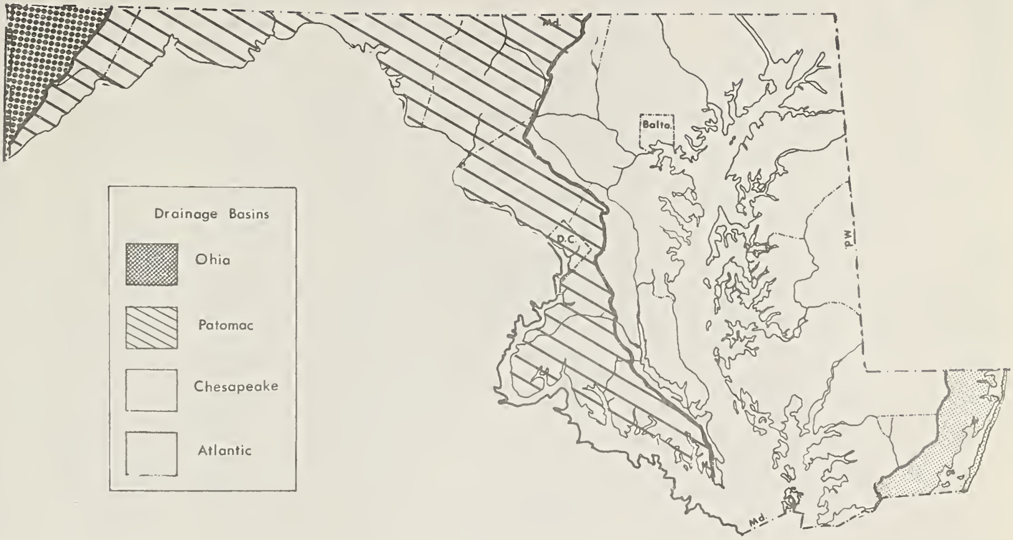


Figure 3. Drainage Basins of Maryland

● Specimen examined, and/or unquestionable published record.

o Specimen reported, and/or questionable published record.

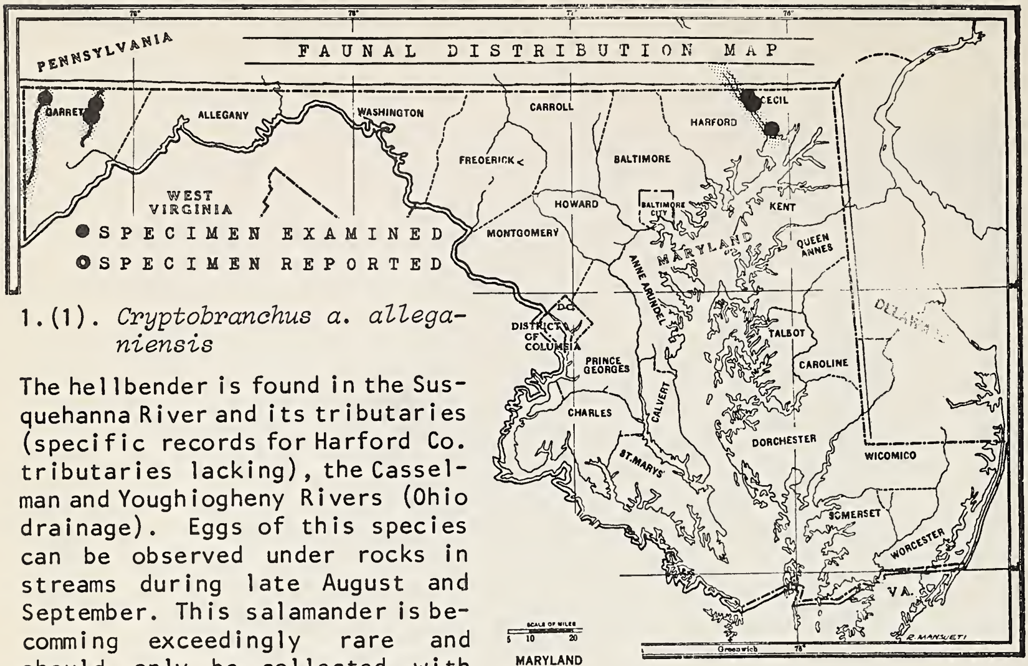
County record, exact locality unknown.

Expected distribution.

---- Extent of distribution.

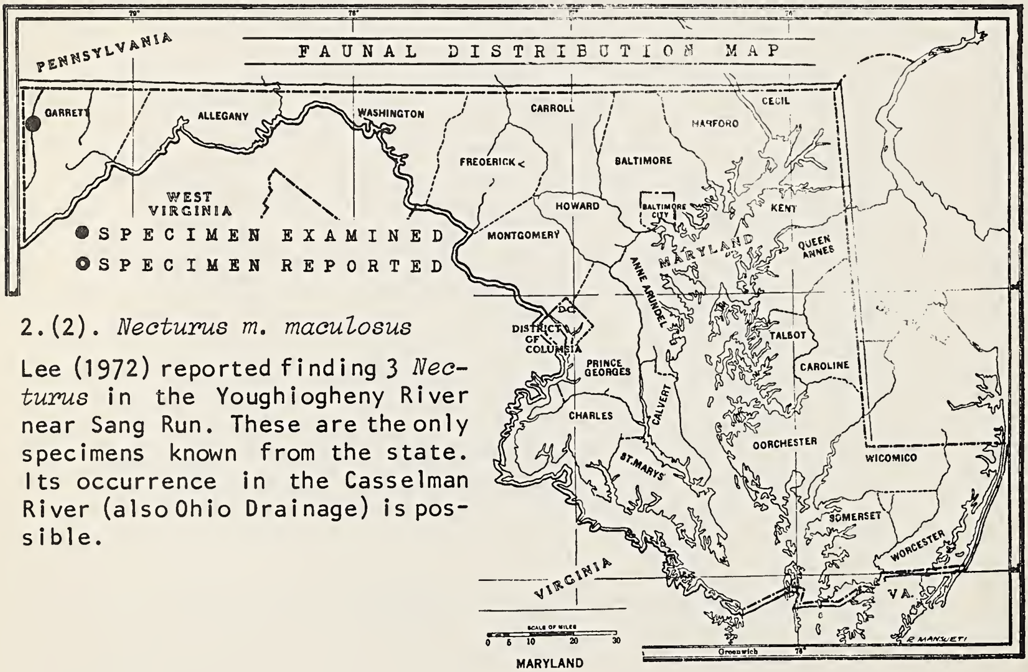
—·—·— Possible extent of distribution. The approximate northern limits of pure stands of the loblolly pine (Conant, 1945).

Figure 4. Legend for Maps 1 - 94



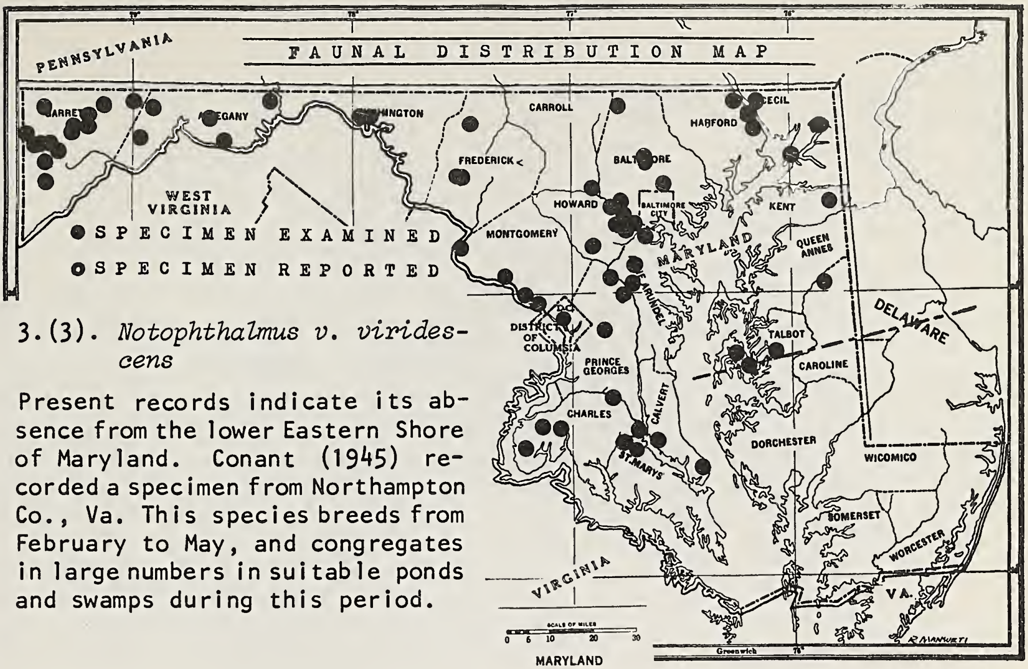
1.(1). *Cryptobranchus a. alleganiensis*

The hellbender is found in the Susquehanna River and its tributaries (specific records for Harford Co. tributaries lacking), the Casselman and Youghiogheny Rivers (Ohio drainage). Eggs of this species can be observed under rocks in streams during late August and September. This salamander is becomming exceedingly rare and should only be collected with discretion.



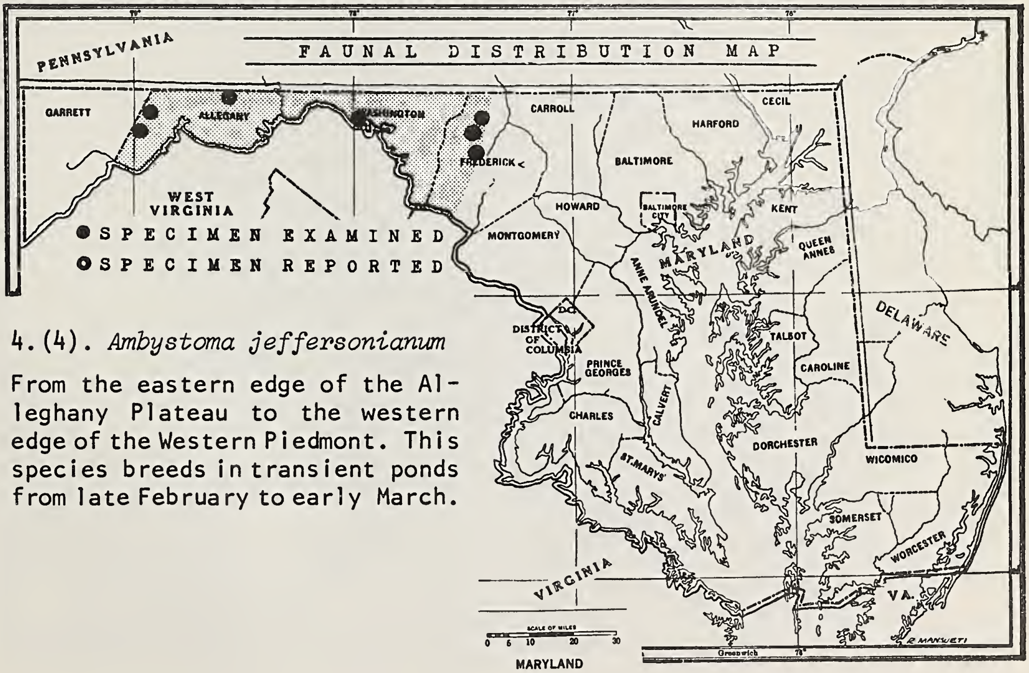
2.(2). *Necturus m. maculosus*

Lee (1972) reported finding 3 *Necturus* in the Youghiogheny River near Sang Run. These are the only specimens known from the state. Its occurrence in the Casselman River (also Ohio Drainage) is possible.



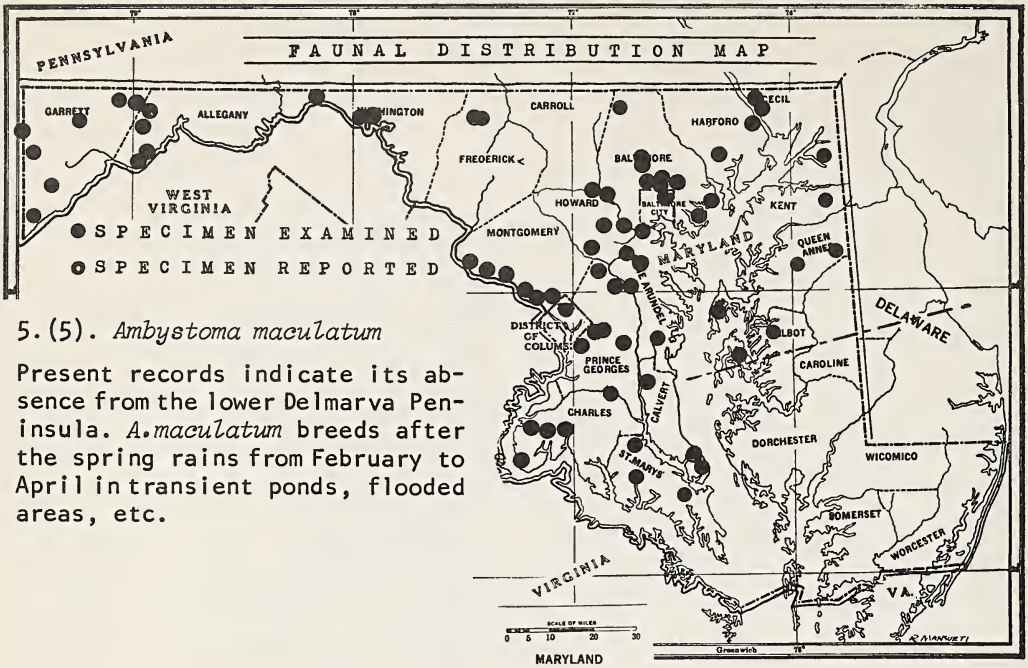
3.(3). *Notophthalmus v. viridescens*

Present records indicate its absence from the lower Eastern Shore of Maryland. Conant (1945) recorded a specimen from Northampton Co., Va. This species breeds from February to May, and congregates in large numbers in suitable ponds and swamps during this period.



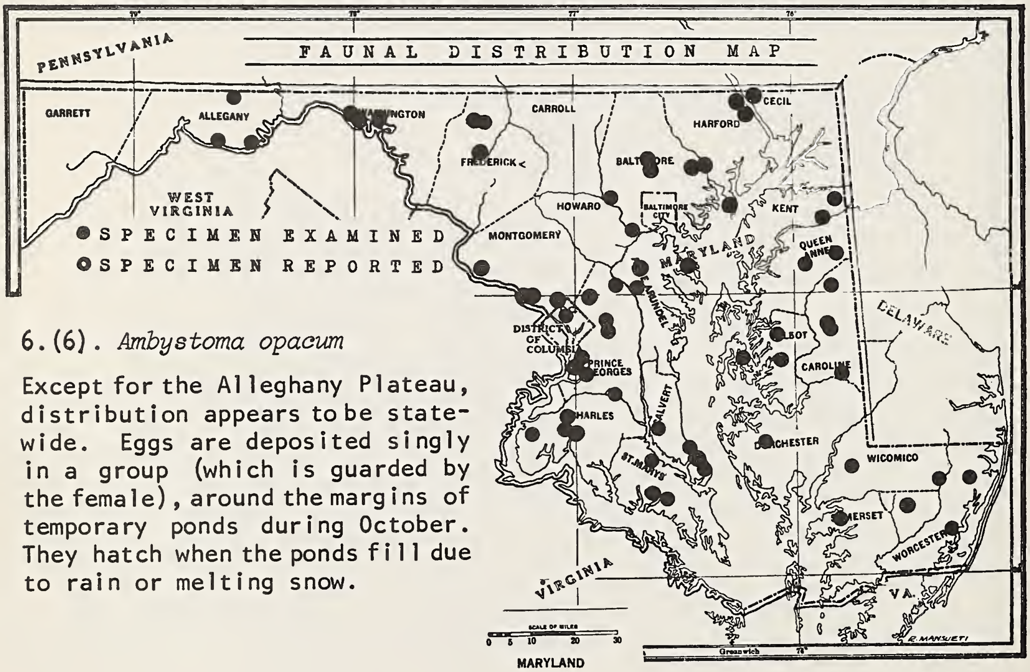
4.(4). *Ambystoma jeffersonianum*

From the eastern edge of the Alleghany Plateau to the western edge of the Western Piedmont. This species breeds in transient ponds from late February to early March.



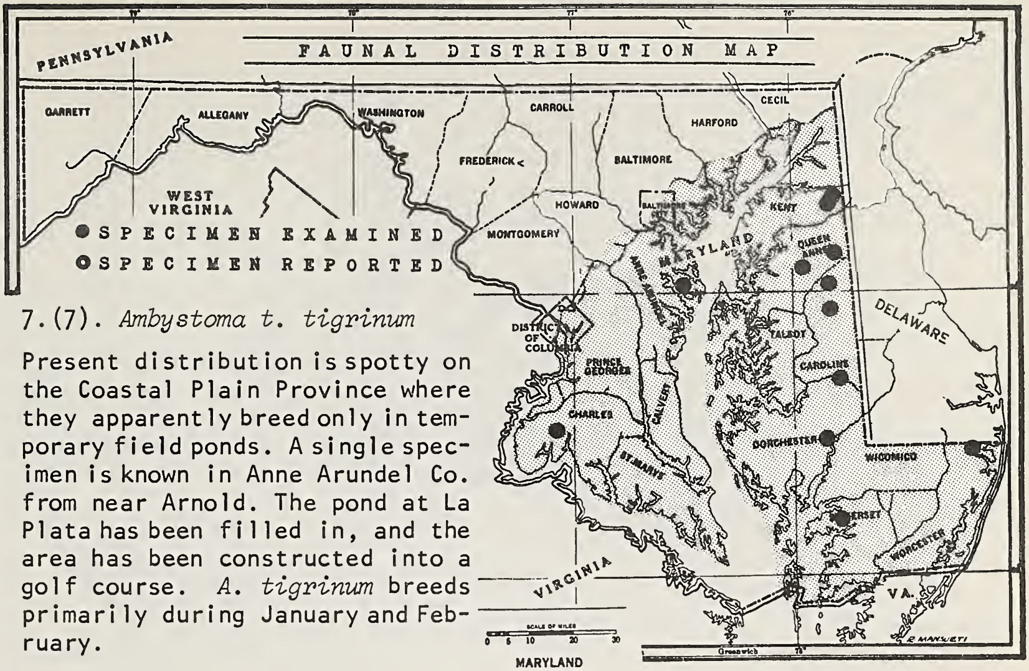
5.(5). *Ambystoma maculatum*

Present records indicate its absence from the lower Delmarva Peninsula. *A.maculatum* breeds after the spring rains from February to April in transient ponds, flooded areas, etc.



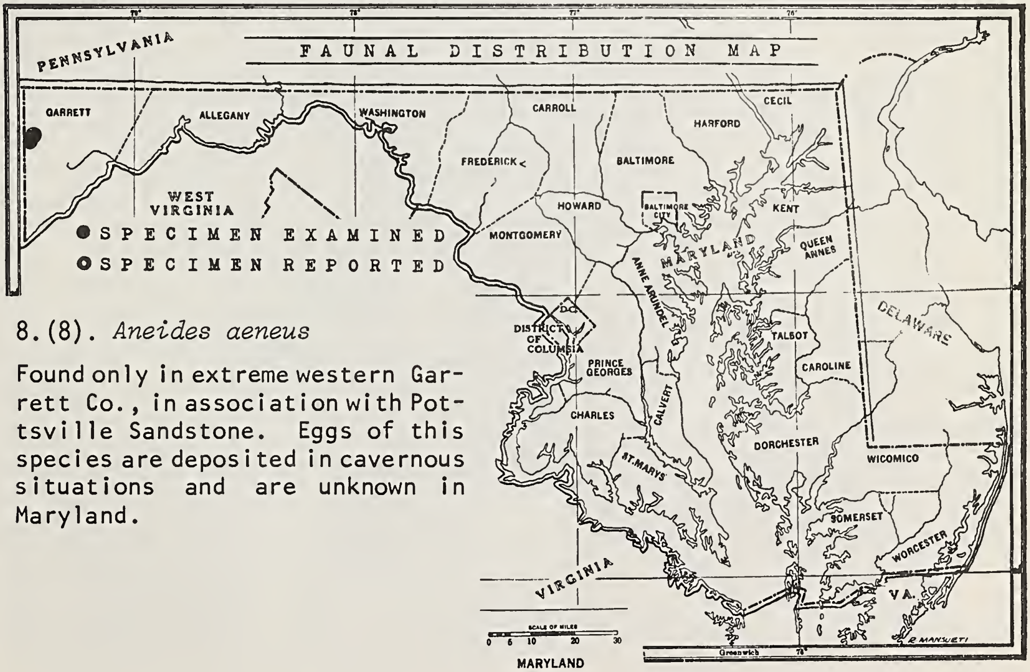
6.(6). *Ambystoma opacum*

Except for the Alleghany Plateau, distribution appears to be statewide. Eggs are deposited singly in a group (which is guarded by the female), around the margins of temporary ponds during October. They hatch when the ponds fill due to rain or melting snow.



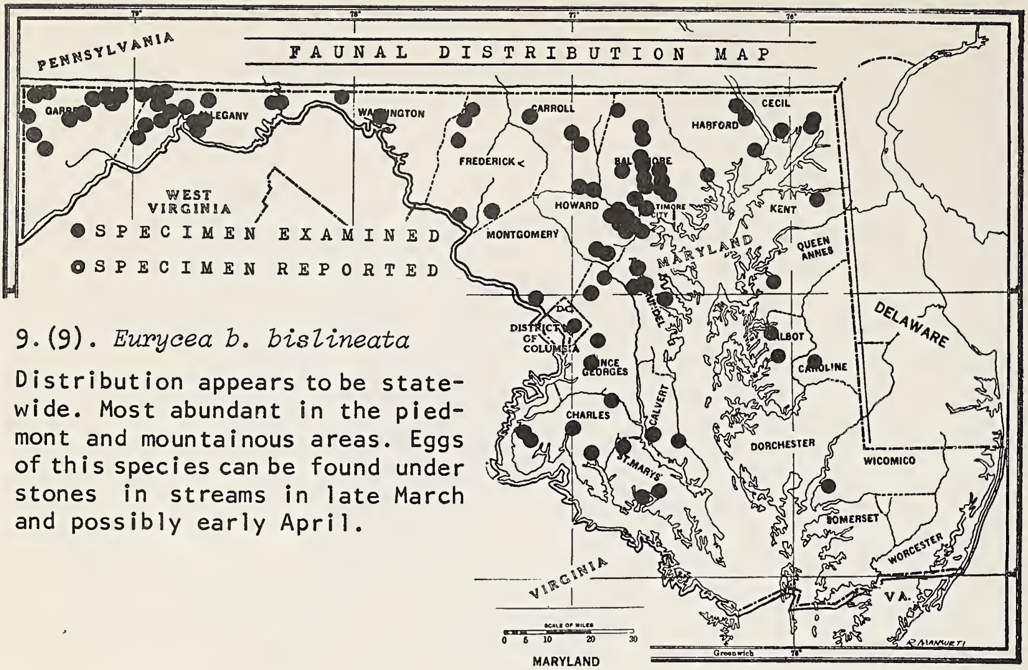
7.(7). *Ambystoma t. tigrinum*

Present distribution is spotty on the Coastal Plain Province where they apparently breed only in temporary field ponds. A single specimen is known in Anne Arundel Co. from near Arnold. The pond at La Plata has been filled in, and the area has been constructed into a golf course. *A. tigrinum* breeds primarily during January and February.



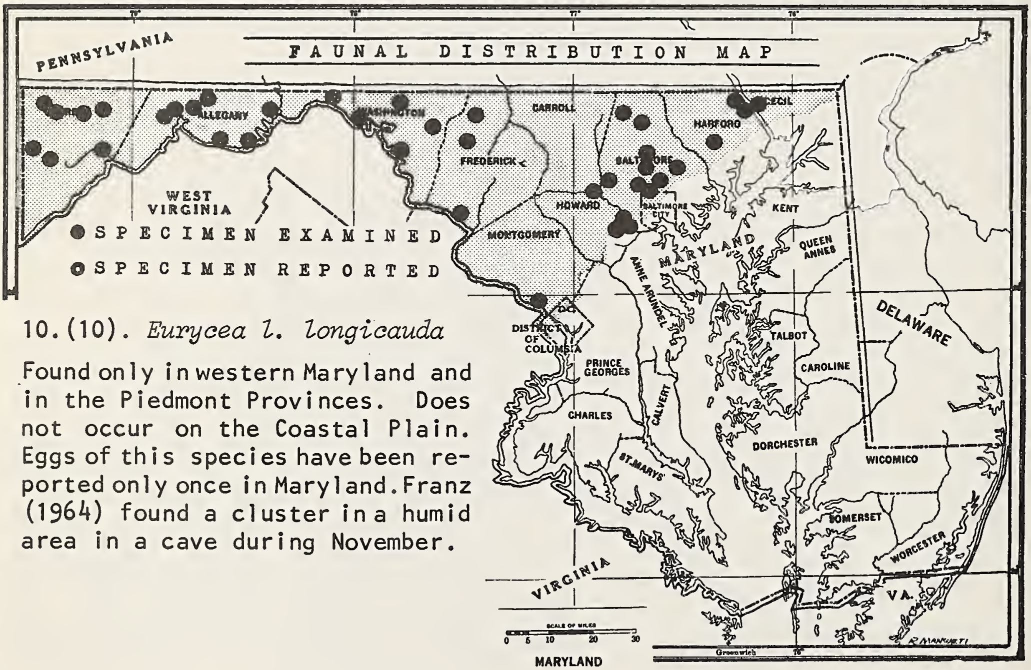
8.(8). *Aneides aeneus*

Found only in extreme western Garrett Co., in association with Pottsville Sandstone. Eggs of this species are deposited in cavernous situations and are unknown in Maryland.



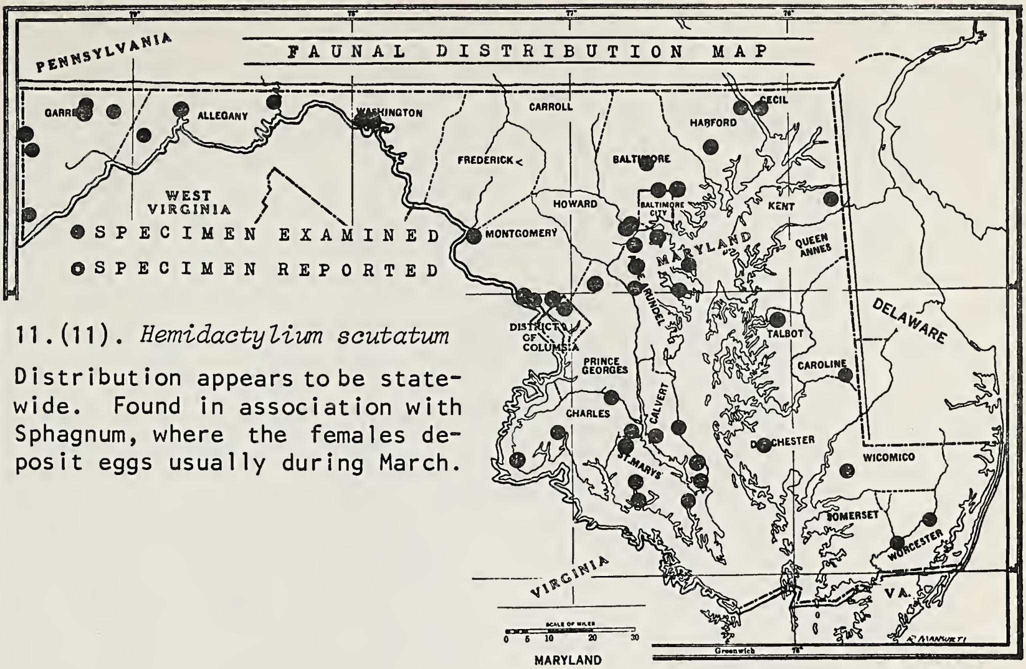
9.(9). *Eurycea b. bislineata*

Distribution appears to be statewide. Most abundant in the piedmont and mountainous areas. Eggs of this species can be found under stones in streams in late March and possibly early April.



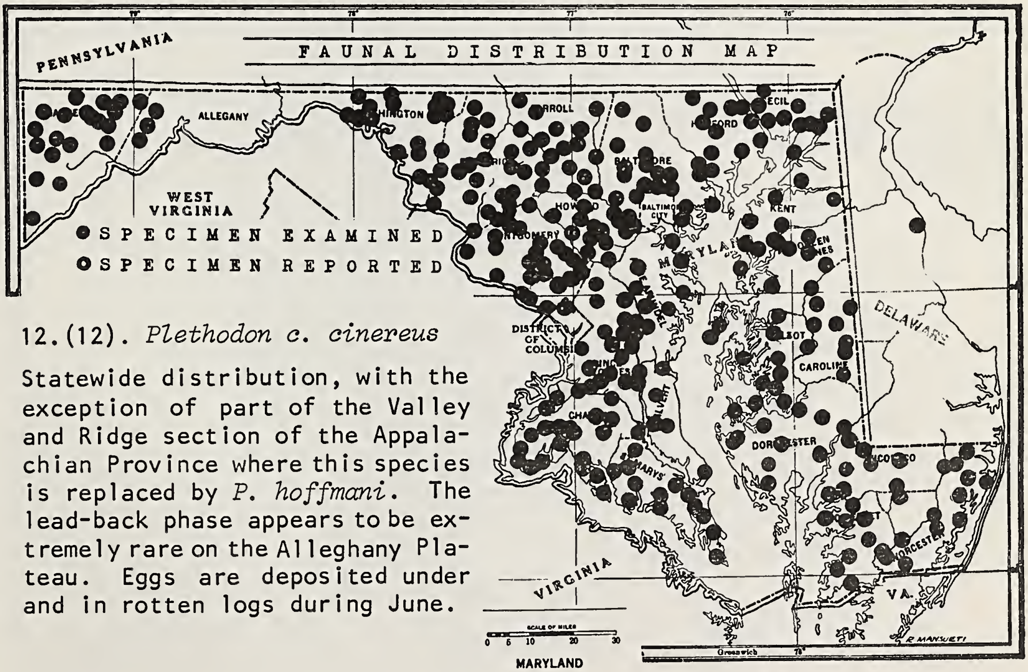
10.(10). *Eurycea l. longicauda*

Found only in western Maryland and in the Piedmont Provinces. Does not occur on the Coastal Plain. Eggs of this species have been reported only once in Maryland. Franz (1964) found a cluster in a humid area in a cave during November.



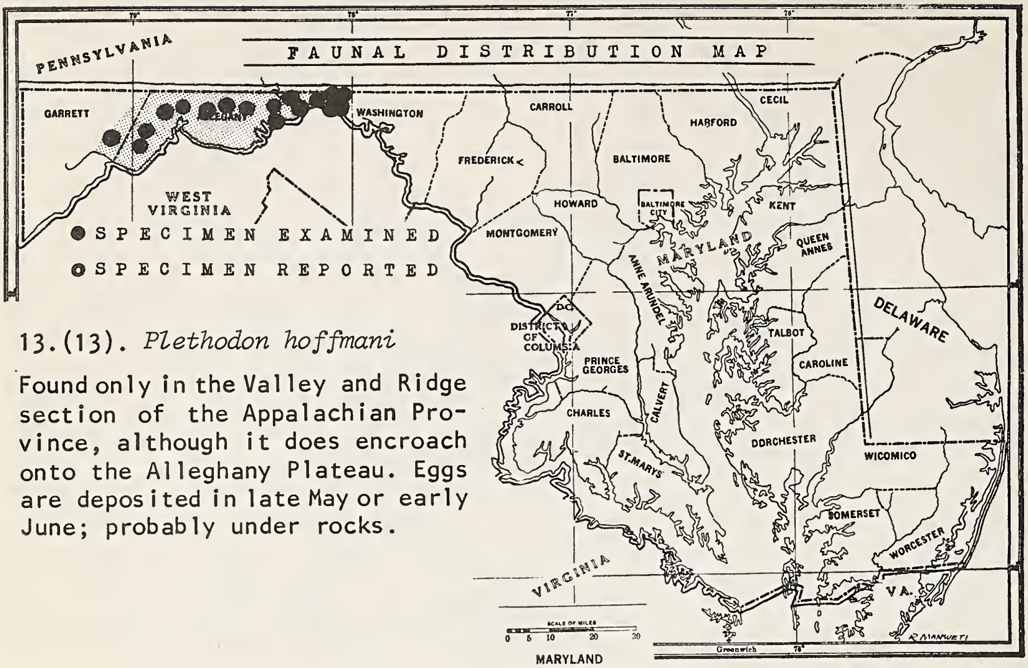
11.(11). *Hemidactylium scutatum*

Distribution appears to be statewide. Found in association with Sphagnum, where the females deposit eggs usually during March.



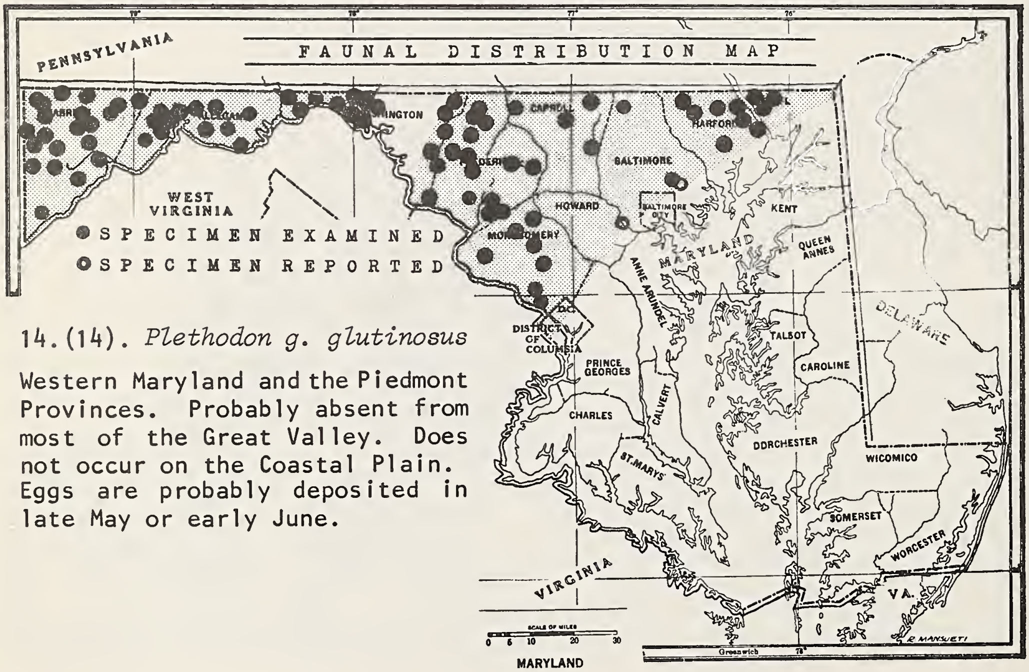
12.(12). *Plethodon c. cinereus*

Statewide distribution, with the exception of part of the Valley and Ridge section of the Appalachian Province where this species is replaced by *P. hoffmani*. The lead-back phase appears to be extremely rare on the Alleghany Plateau. Eggs are deposited under and in rotten logs during June.



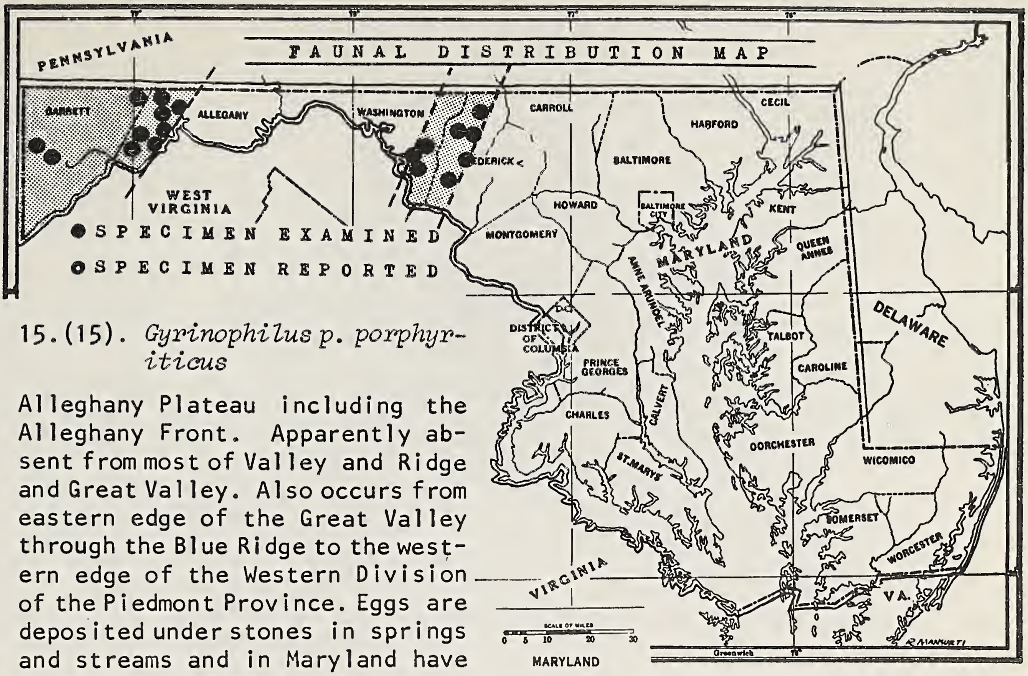
13.(13). *Plethodon hoffmani*

Found only in the Valley and Ridge section of the Appalachian Province, although it does encroach onto the Alleghany Plateau. Eggs are deposited in late May or early June; probably under rocks.



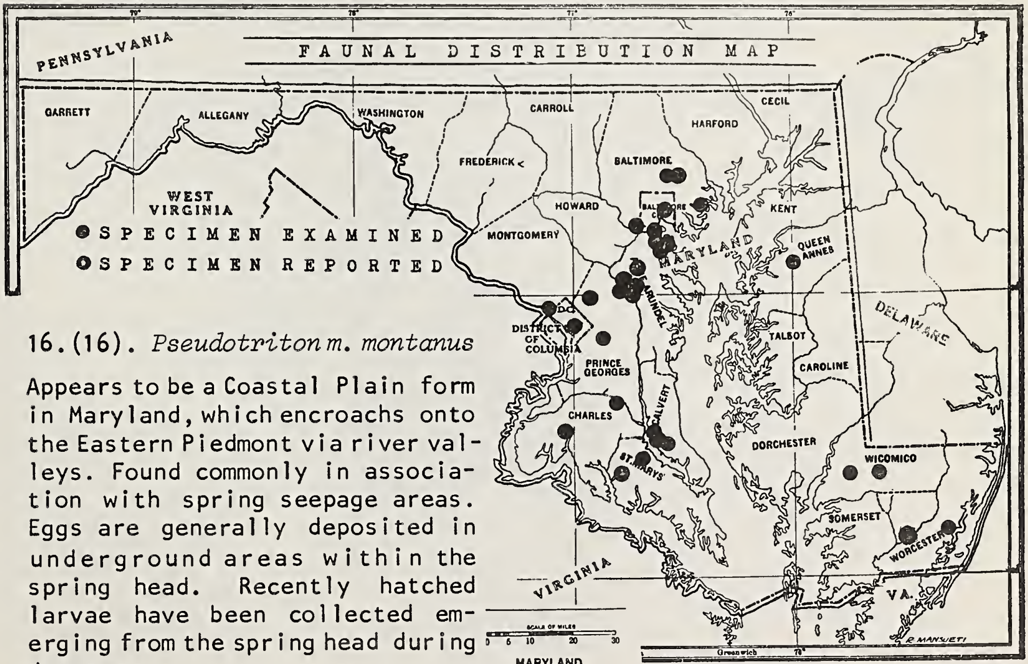
14.(14). *Plethodon g. glutinosus*

Western Maryland and the Piedmont Provinces. Probably absent from most of the Great Valley. Does not occur on the Coastal Plain. Eggs are probably deposited in late May or early June.



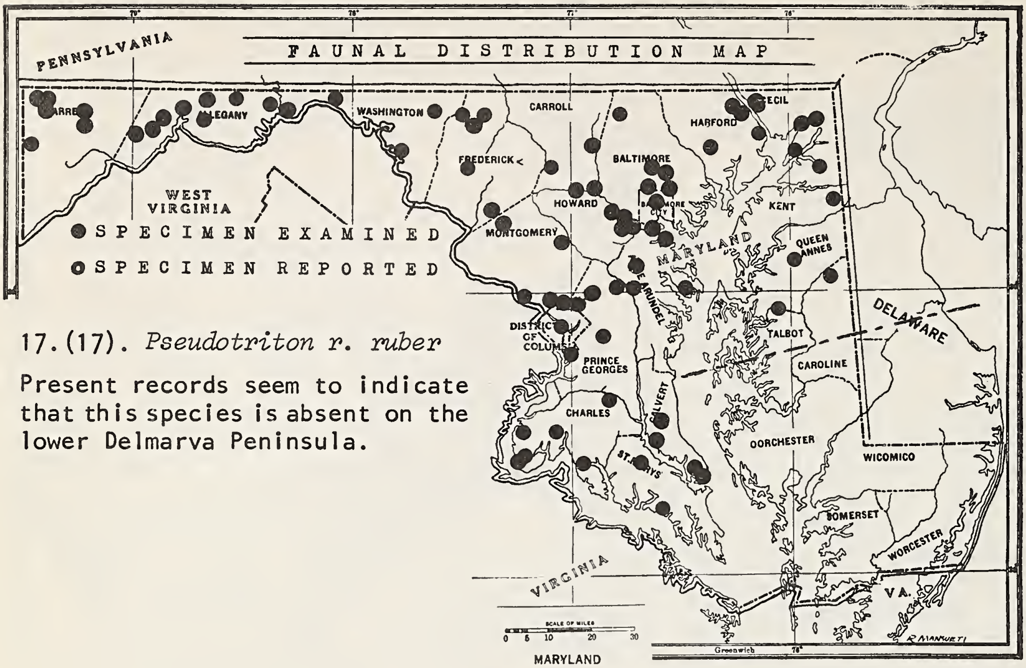
15.(15). *Gyrinophilus p. porphyriticus*

Alleghany Plateau including the Alleghany Front. Apparently absent from most of Valley and Ridge and Great Valley. Also occurs from eastern edge of the Great Valley through the Blue Ridge to the western edge of the Western Division of the Piedmont Province. Eggs are deposited under stones in springs and streams and in Maryland have been reported during early September.



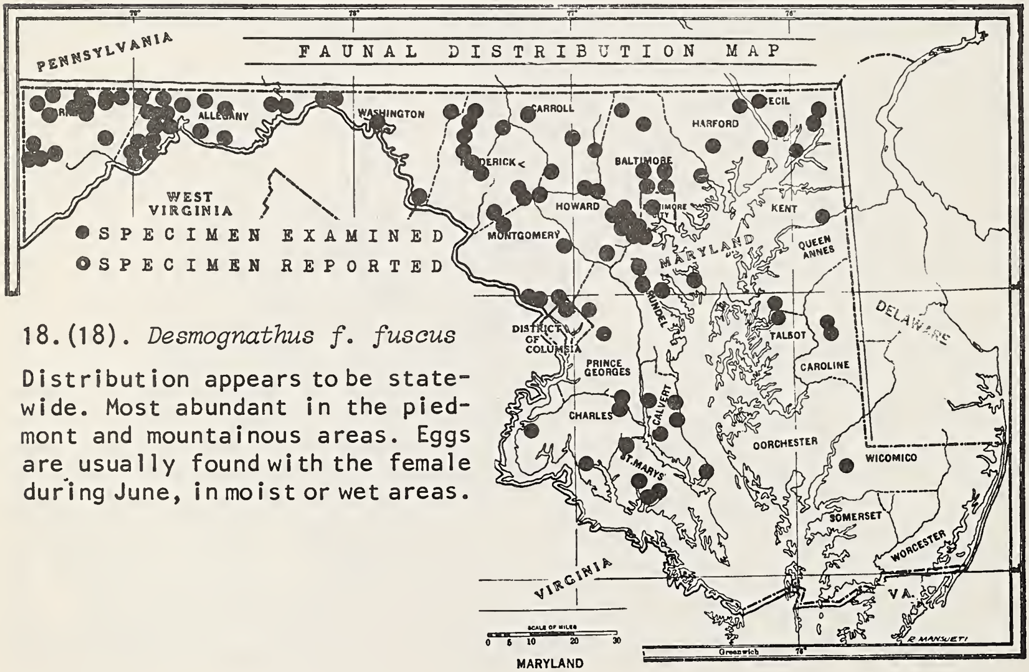
16.(16). *Pseudotriton m. montanus*

Appears to be a Coastal Plain form in Maryland, which encroachs onto the Eastern Piedmont via river valleys. Found commonly in association with spring seepage areas. Eggs are generally deposited in underground areas within the spring head. Recently hatched larvae have been collected emerging from the spring head during January.



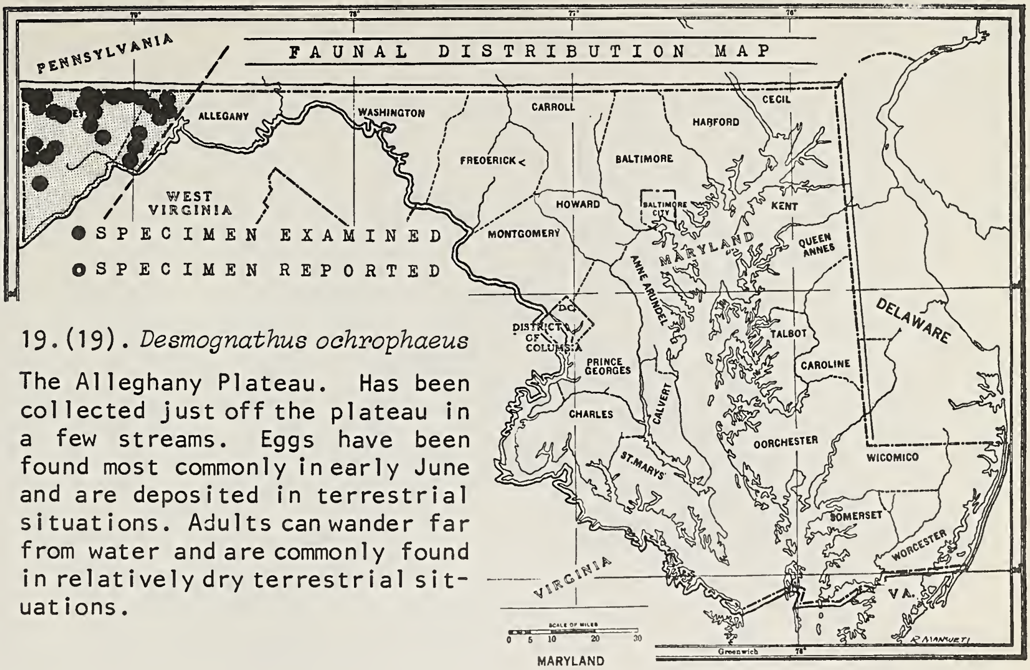
17.(17). *Pseudotriton r. ruber*

Present records seem to indicate that this species is absent on the lower Delmarva Peninsula.



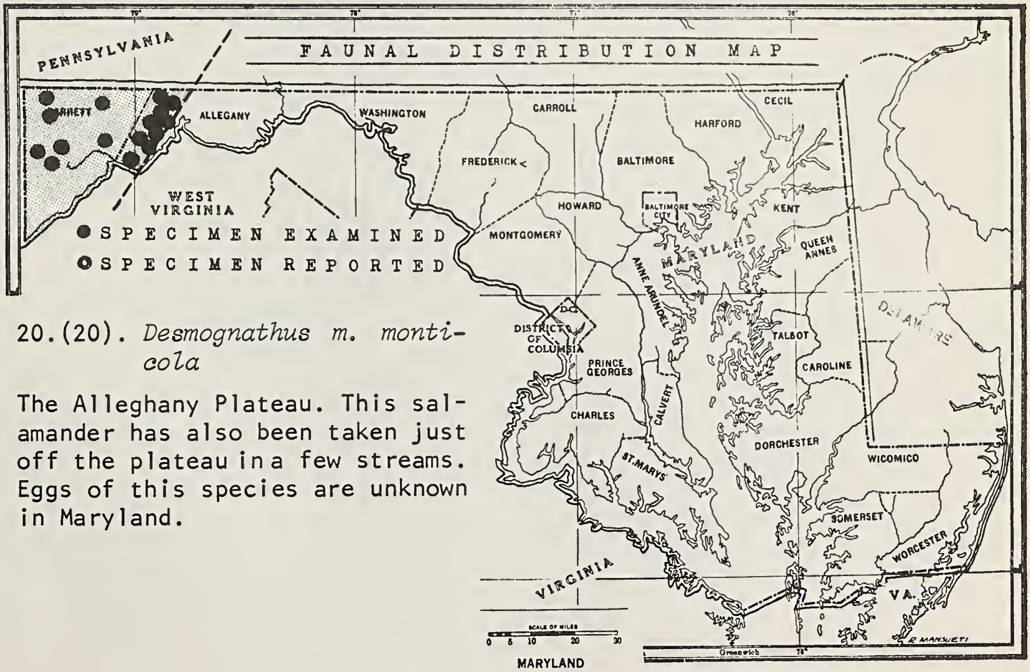
18.(18). *Desmognathus f. fuscus*

Distribution appears to be statewide. Most abundant in the piedmont and mountainous areas. Eggs are usually found with the female during June, in moist or wet areas.



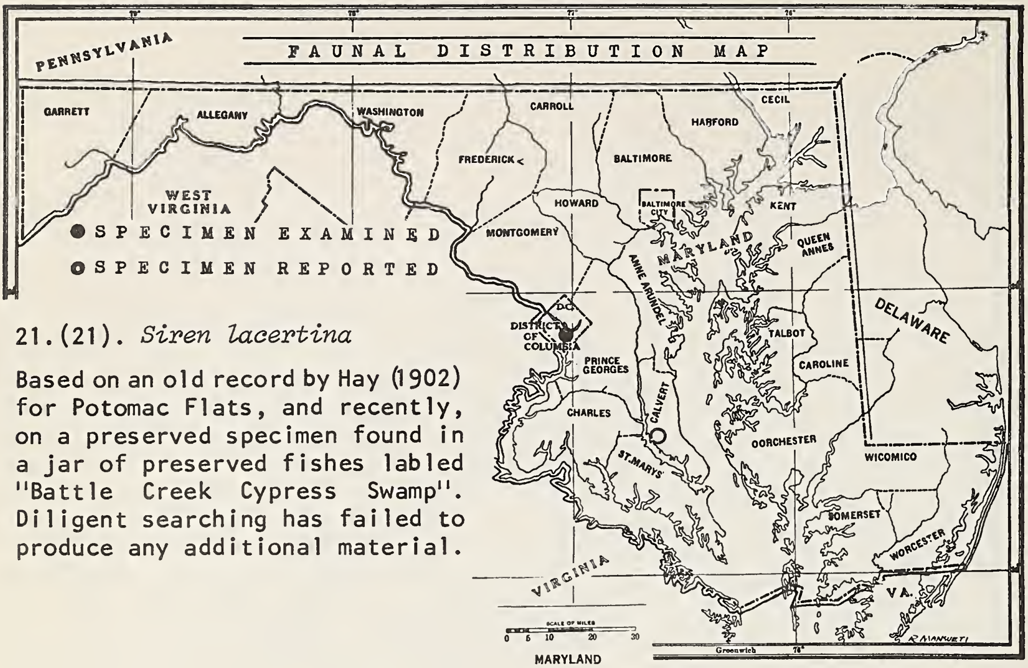
19.(19). *Desmognathus ochrophaeus*

The Alleghany Plateau. Has been collected just off the plateau in a few streams. Eggs have been found most commonly in early June and are deposited in terrestrial situations. Adults can wander far from water and are commonly found in relatively dry terrestrial situations.



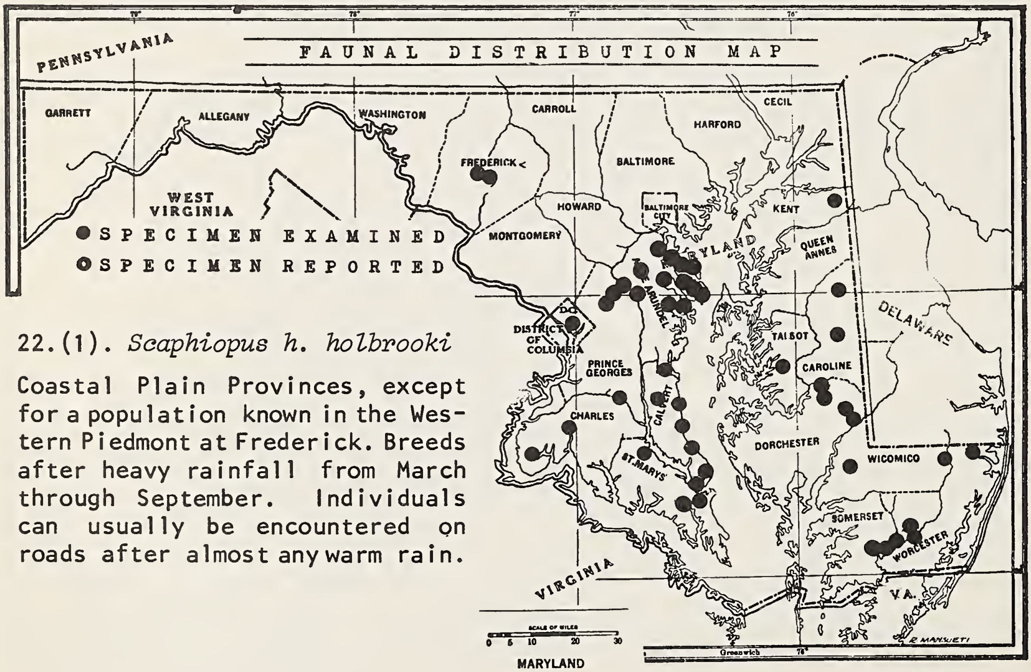
20.(20). *Desmognathus m. monticola*

The Alleghany Plateau. This salamander has also been taken just off the plateau in a few streams. Eggs of this species are unknown in Maryland.



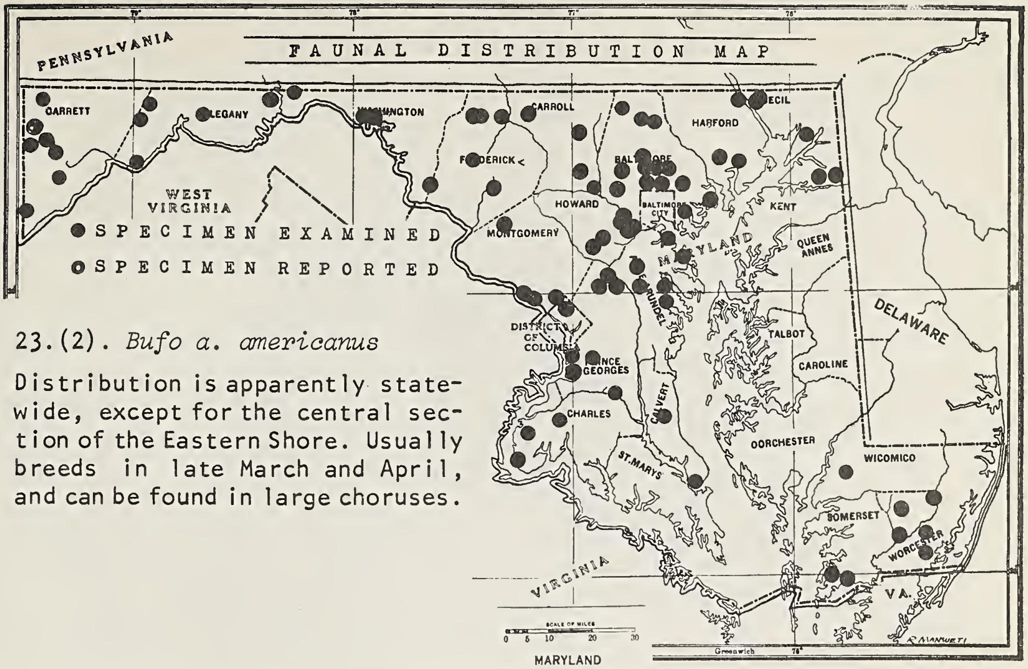
21.(21). *Siren lacertina*

Based on an old record by Hay (1902) for Potomac Flats, and recently, on a preserved specimen found in a jar of preserved fishes labled "Battle Creek Cypress Swamp". Diligent searching has failed to produce any additional material.



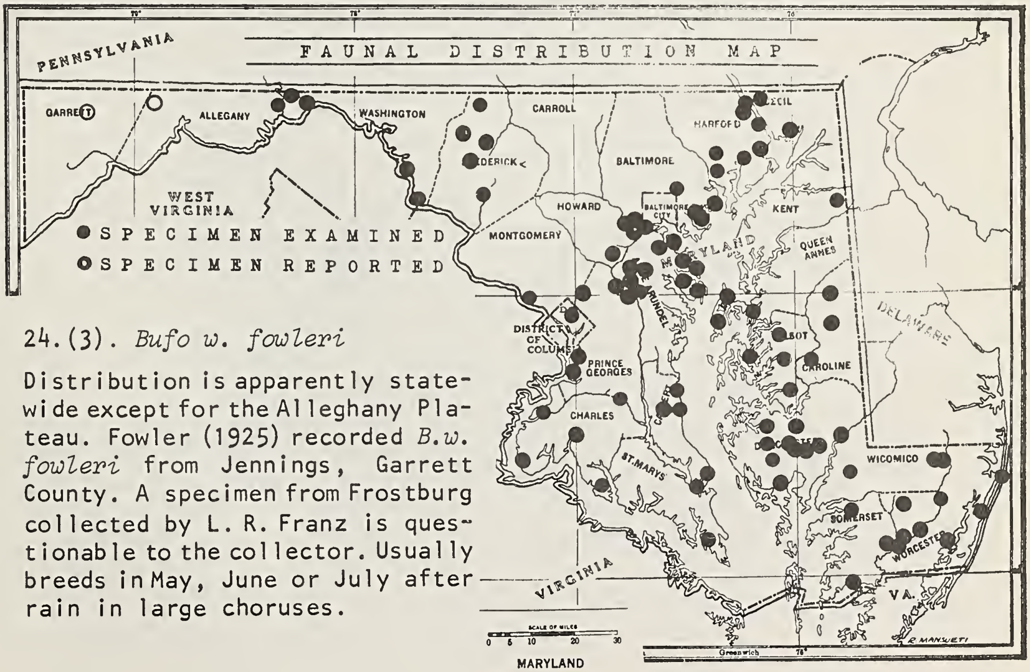
22.(1). *Scaphiopus h. holbrooki*

Coastal Plain Provinces, except for a population known in the Western Piedmont at Frederick. Breeds after heavy rainfall from March through September. Individuals can usually be encountered on roads after almost any warm rain.



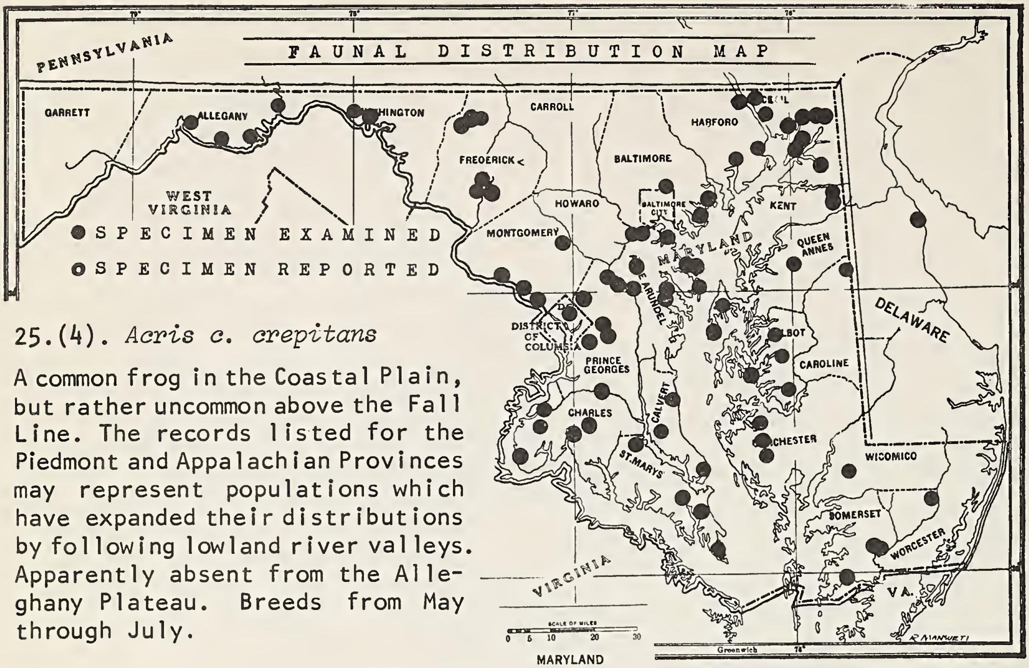
23.(2). *Bufo a. americanus*

Distribution is apparently state-wide, except for the central section of the Eastern Shore. Usually breeds in late March and April, and can be found in large choruses.



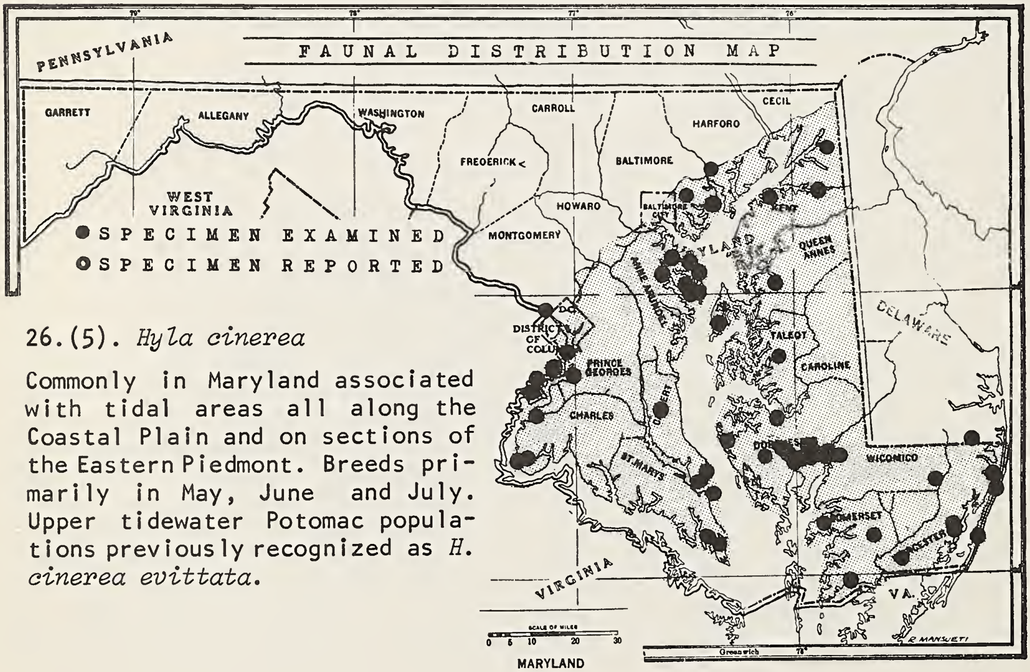
24.(3). *Bufo w. fowleri*

Distribution is apparently state-wide except for the Alleghany Plateau. Fowler (1925) recorded *B.w. fowleri* from Jennings, Garrett County. A specimen from Frostburg collected by L. R. Franz is questionable to the collector. Usually breeds in May, June or July after rain in large choruses.



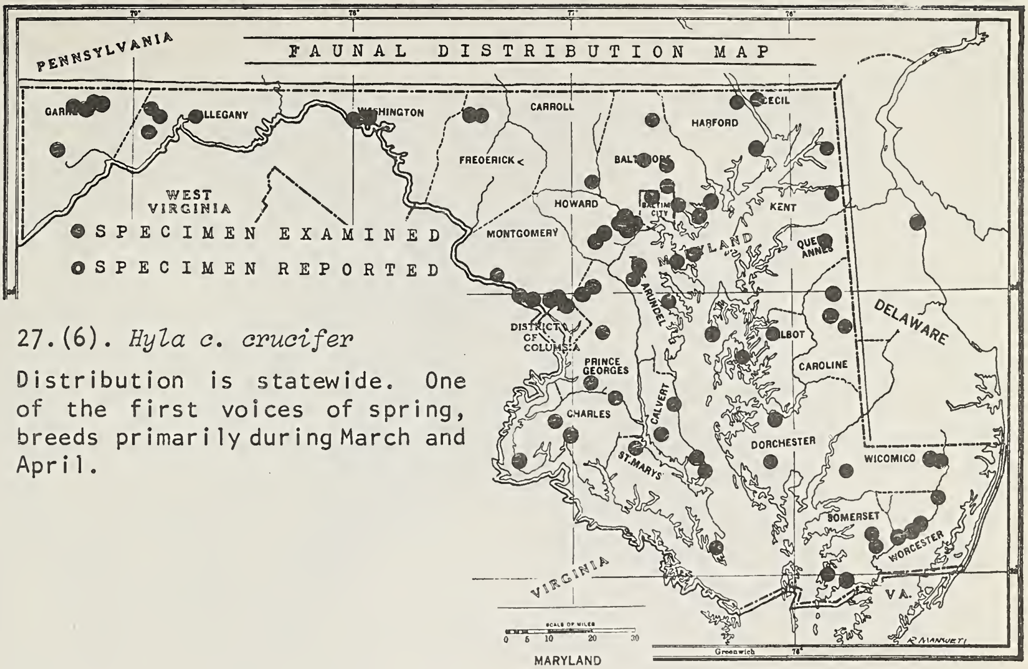
25.(4). *Acris c. crepitans*

A common frog in the Coastal Plain, but rather uncommon above the Fall Line. The records listed for the Piedmont and Appalachian Provinces may represent populations which have expanded their distributions by following lowland river valleys. Apparently absent from the Alleghany Plateau. Breeds from May through July.



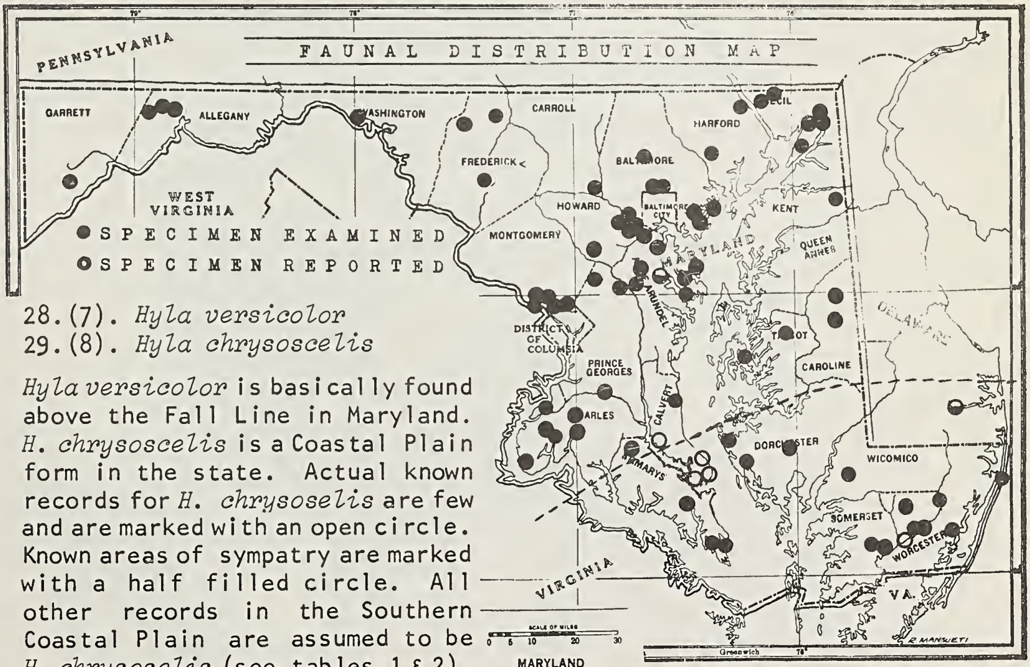
26.(5). *Hyla cinerea*

Commonly in Maryland associated with tidal areas all along the Coastal Plain and on sections of the Eastern Piedmont. Breeds primarily in May, June and July. Upper tidewater Potomac populations previously recognized as *H. cinerea evittata*.



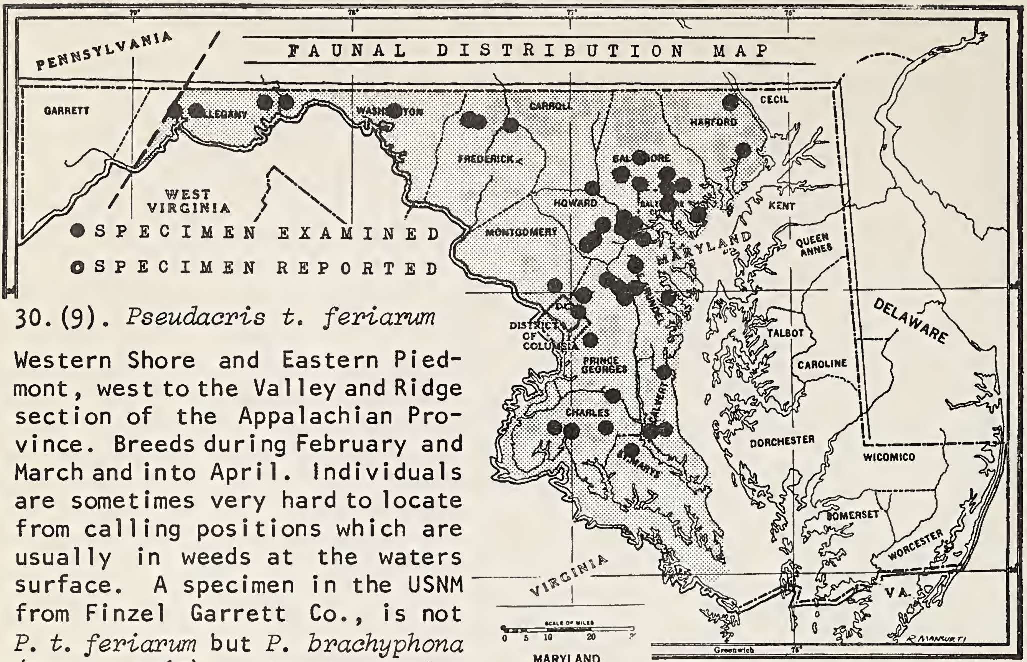
27.(6). *Hyla c. crucifer*

Distribution is statewide. One of the first voices of spring, breeds primarily during March and April.



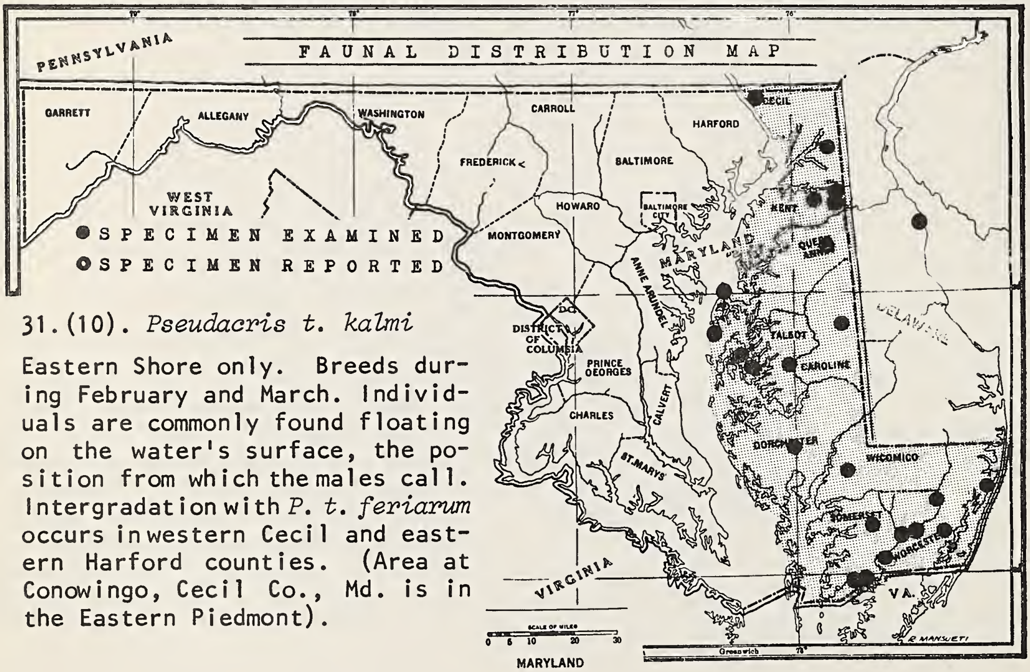
28.(7). *Hyla versicolor*
29.(8). *Hyla chrysoscelis*

Hyla versicolor is basically found above the Fall Line in Maryland. *H. chrysoscelis* is a Coastal Plain form in the state. Actual known records for *H. chrysoselis* are few and are marked with an open circle. Known areas of sympatry are marked with a half filled circle. All other records in the Southern Coastal Plain are assumed to be *H. chrysoselis* (see tables 1 & 2). The distribution line shown is after Ralin (1968), and is somewhat low. See also Zweifel (1970). *H. veriscolor* breeds from May - July and *H. chrysoscelis* from May - August.



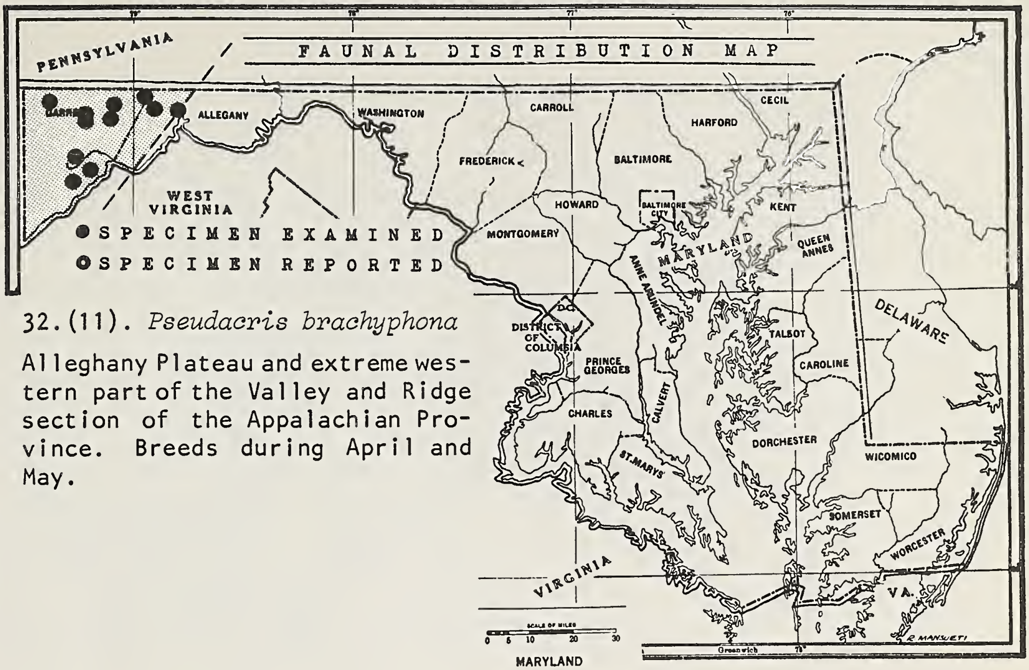
30. (9). *Pseudacris t. feriarum*

Western Shore and Eastern Piedmont, west to the Valley and Ridge section of the Appalachian Province. Breeds during February and March and into April. Individuals are sometimes very hard to locate from calling positions which are usually in weeds at the waters surface. A specimen in the USNM from Finzel Garrett Co., is not *P. t. feriarum* but *P. brachyphona* (Franz, 1967). Intergradation with *P. t. kalmi* occurs in eastern Harford and western Cecil counties.



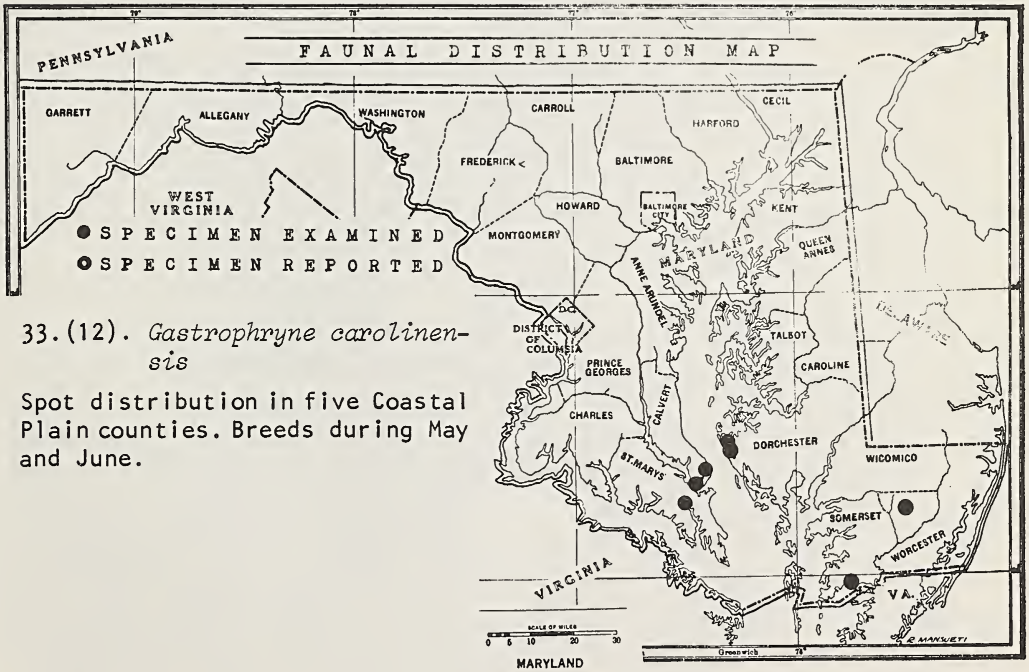
31. (10). *Pseudacris t. kalmi*

Eastern Shore only. Breeds during February and March. Individuals are commonly found floating on the water's surface, the position from which the males call. Intergradation with *P. t. feriarum* occurs in western Cecil and eastern Harford counties. (Area at Conowingo, Cecil Co., Md. is in the Eastern Piedmont).



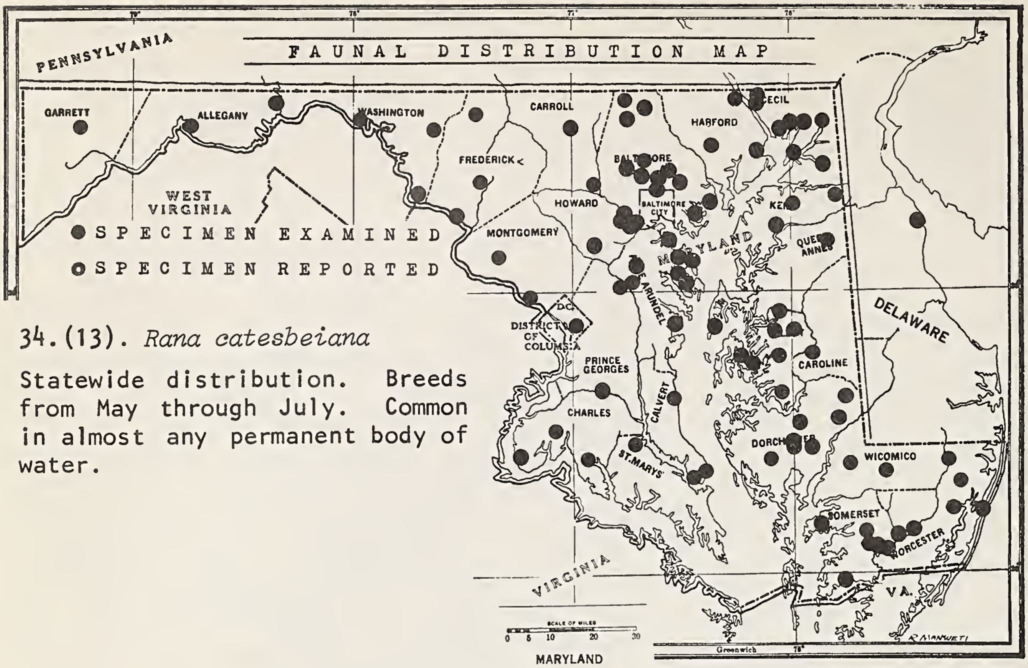
32.(11). *Pseudacris brachyphona*

Alleghany Plateau and extreme western part of the Valley and Ridge section of the Appalachian Province. Breeds during April and May.



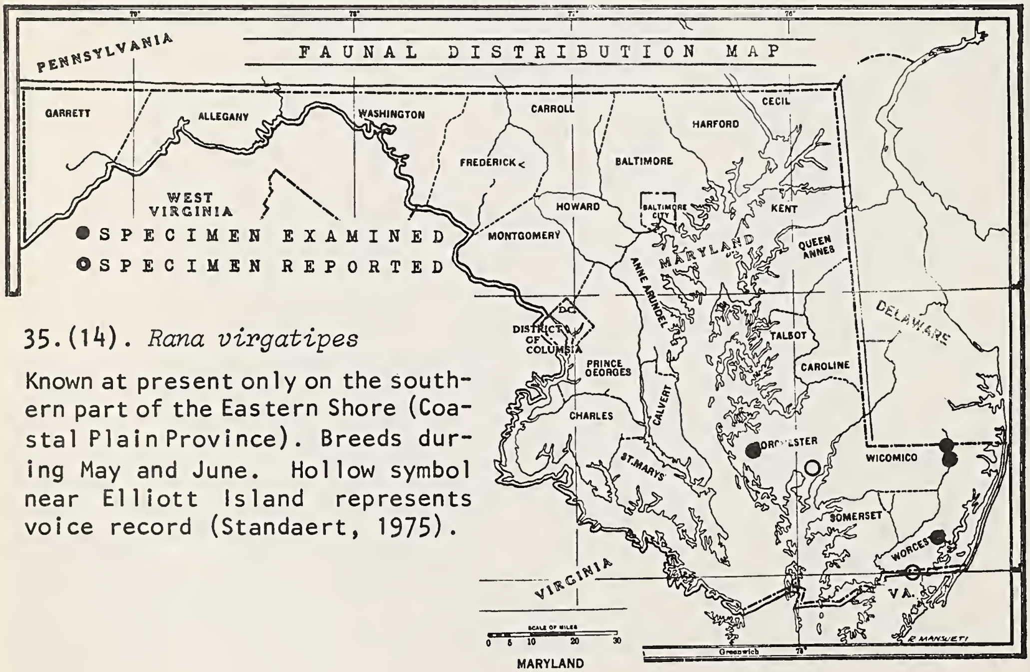
33.(12). *Gastrophryne carolinensis*

Spot distribution in five Coastal Plain counties. Breeds during May and June.



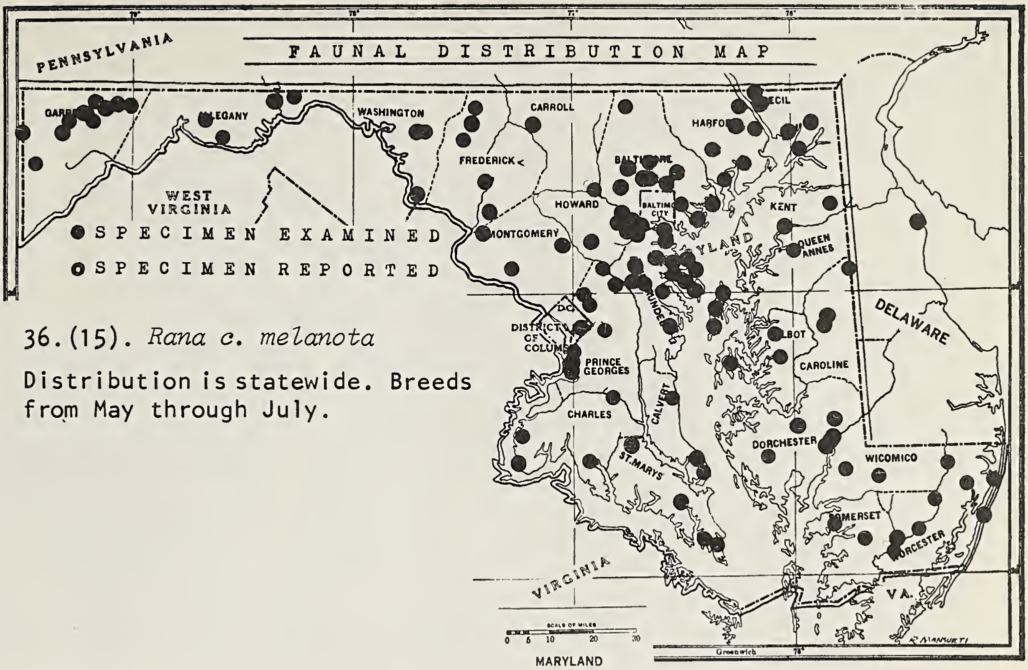
34.(13). *Rana catesbeiana*

Statewide distribution. Breeds from May through July. Common in almost any permanent body of water.



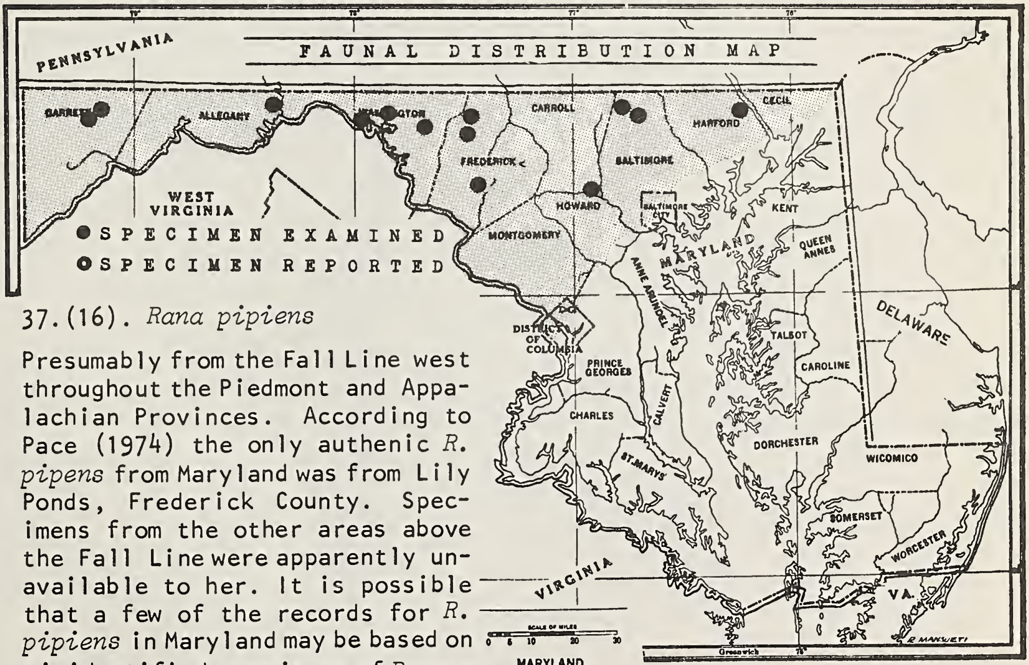
35.(14). *Rana virgatipes*

Known at present only on the southern part of the Eastern Shore (Coastal Plain Province). Breeds during May and June. Hollow symbol near Elliott Island represents voice record (Standaert, 1975).



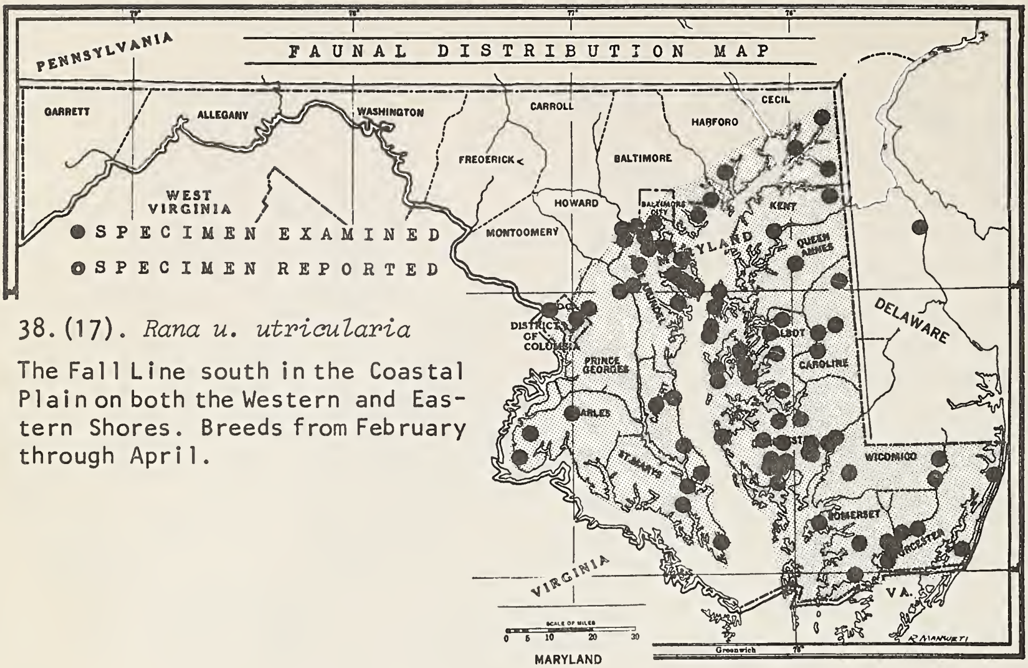
36.(15). *Rana c. melanota*

Distribution is statewide. Breeds from May through July.



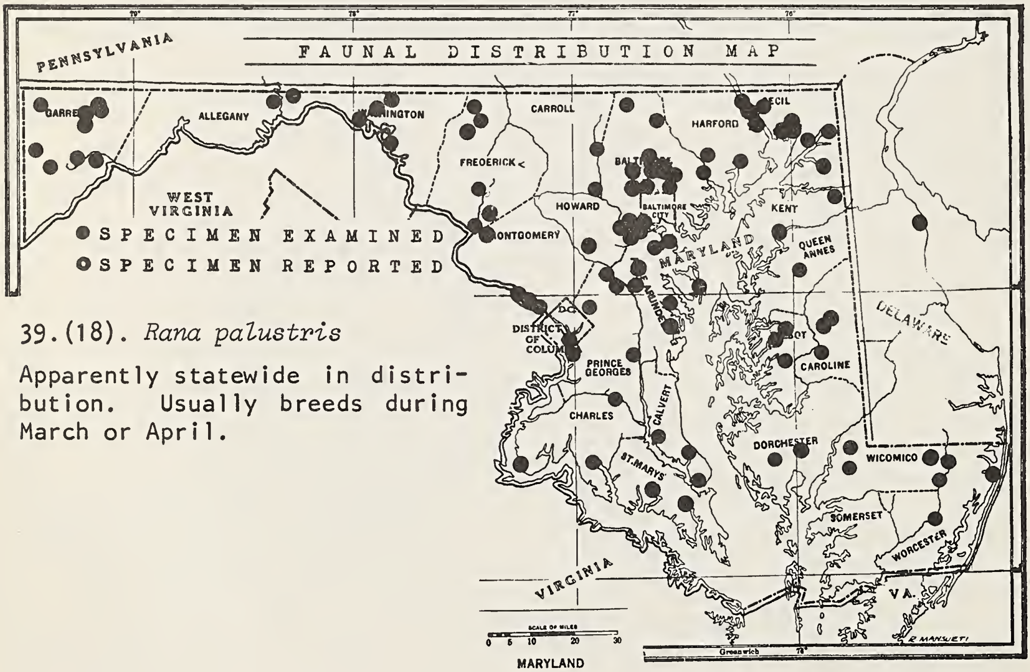
37.(16). *Rana pipiens*

Presumably from the Fall Line west throughout the Piedmont and Appalachian Provinces. According to Pace (1974) the only authenic *R. pipens* from Maryland was from Lily Ponds, Frederick County. Specimens from the other areas above the Fall Line were apparently unavailable to her. It is possible that a few of the records for *R. pipiens* in Maryland may be based on misidentified specimens of *R. palustris* as many literature records were utilized. A very uncommon frog in Maryland.



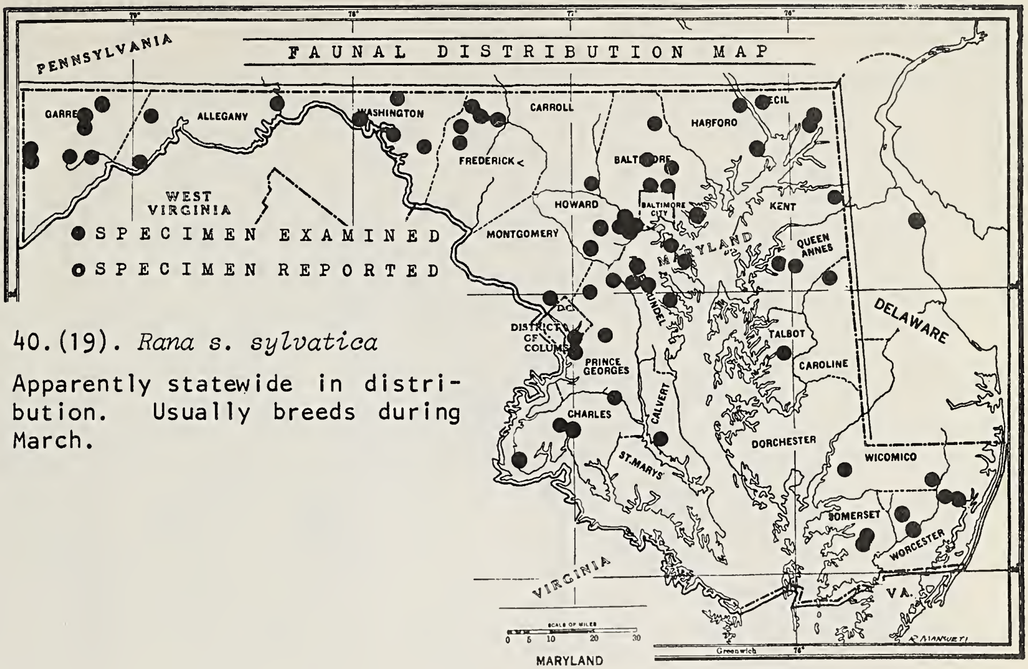
38.(17). *Rana u. utricularia*

The Fall Line south in the Coastal Plain on both the Western and Eastern Shores. Breeds from February through April.



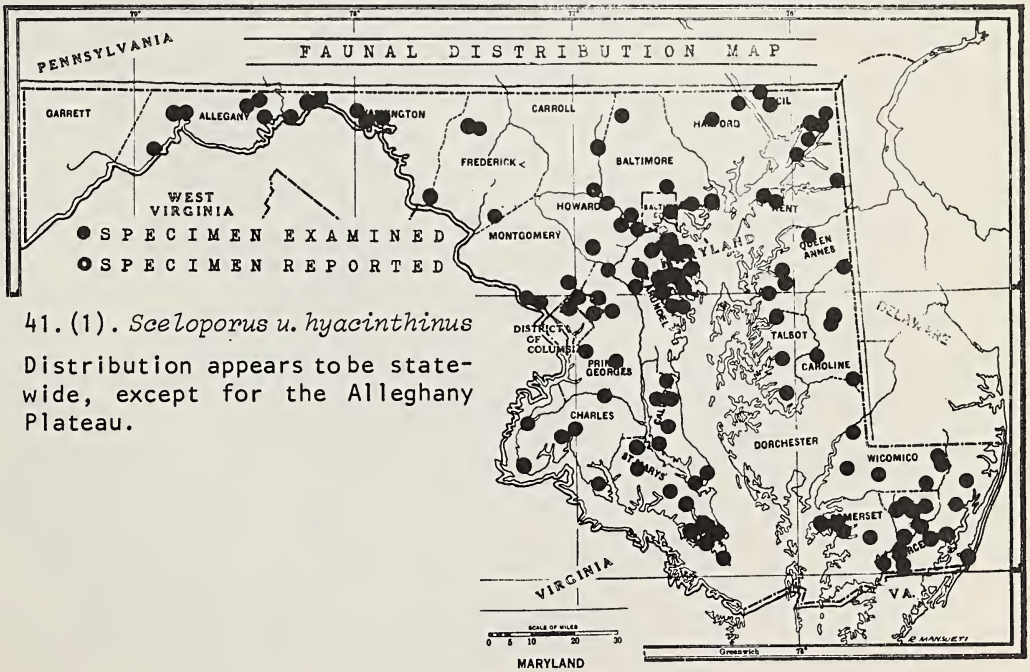
39.(18). *Rana palustris*

Apparently statewide in distribution. Usually breeds during March or April.



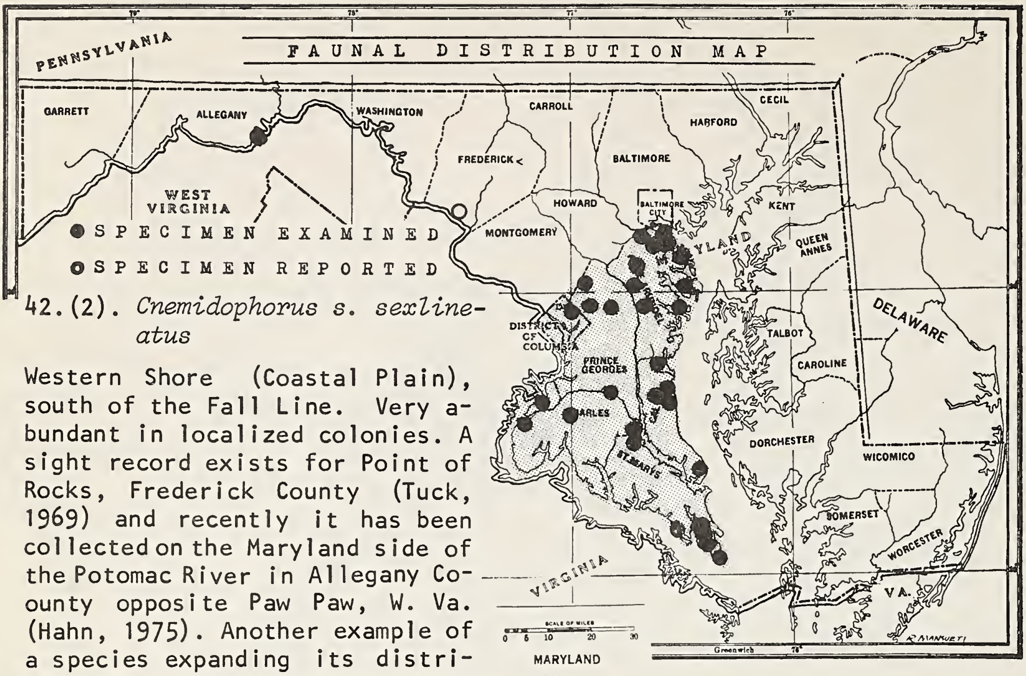
40.(19). *Rana s. sylvatica*

Apparently statewide in distribution. Usually breeds during March.



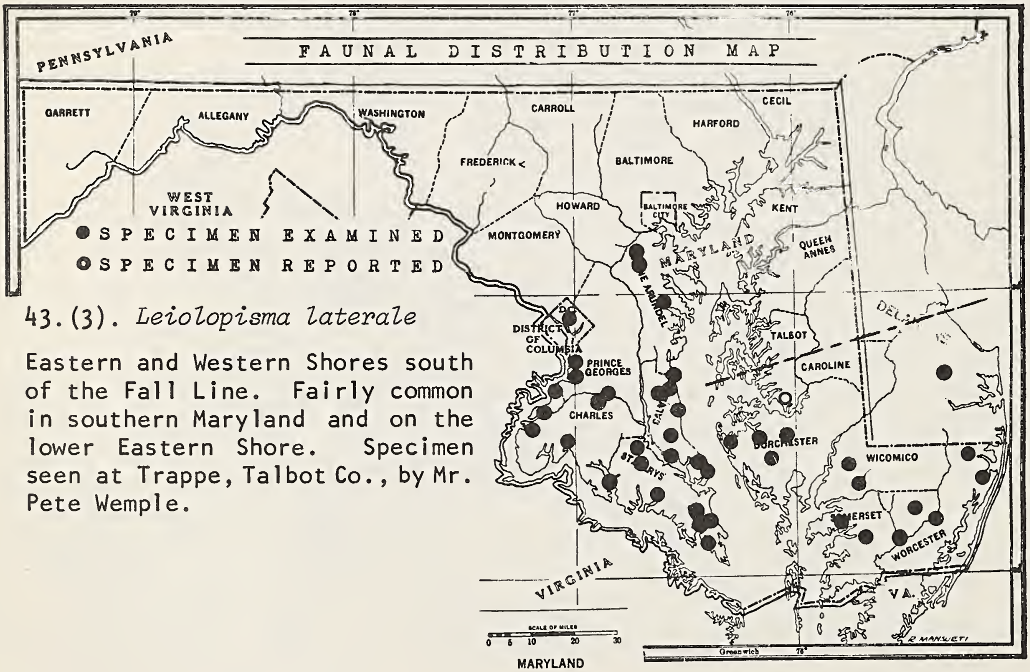
41.(1). *Sceloporus u. hyacinthinus*

Distribution appears to be statewide, except for the Alleghany Plateau.



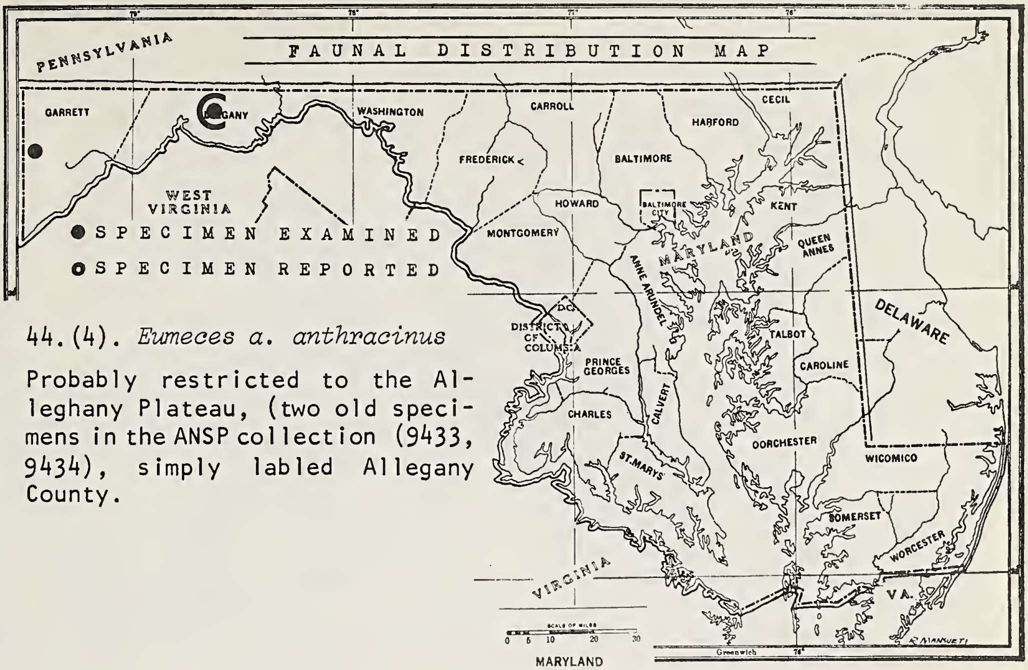
42.(2). *Cnemidophorus s. sexlineatus*

Western Shore (Coastal Plain), south of the Fall Line. Very abundant in localized colonies. A sight record exists for Point of Rocks, Frederick County (Tuck, 1969) and recently it has been collected on the Maryland side of the Potomac River in Allegany County opposite Paw Paw, W. Va. (Hahn, 1975). Another example of a species expanding its distribution by following lowland river valleys.



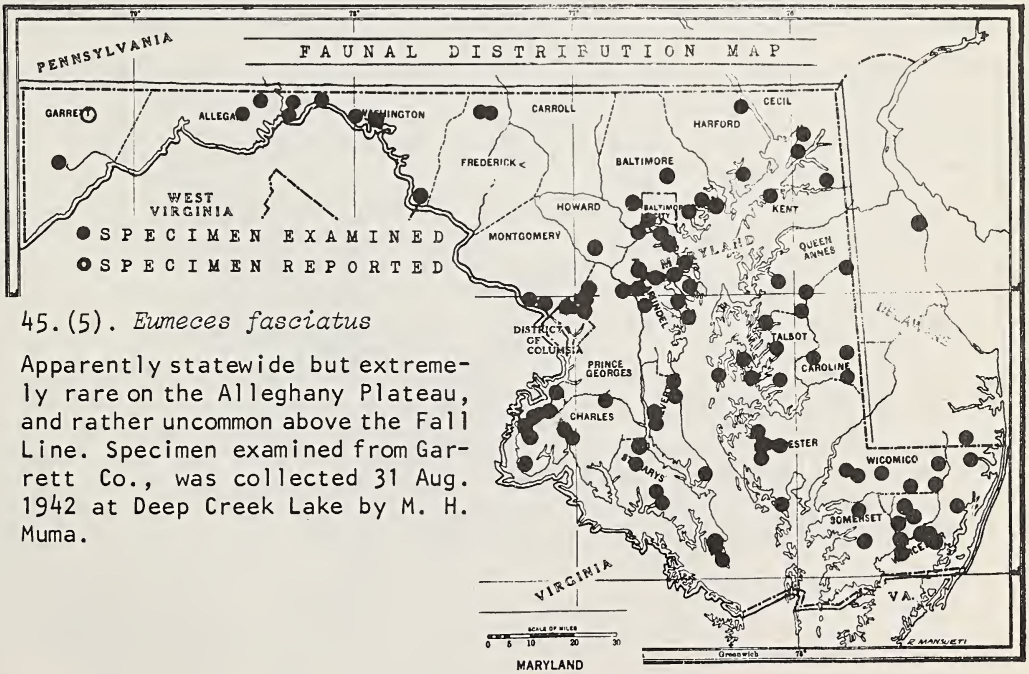
43.(3). *Leiolopisma laterale*

Eastern and Western Shores south of the Fall Line. Fairly common in southern Maryland and on the lower Eastern Shore. Specimen seen at Trappe, Talbot Co., by Mr. Pete Wemple.



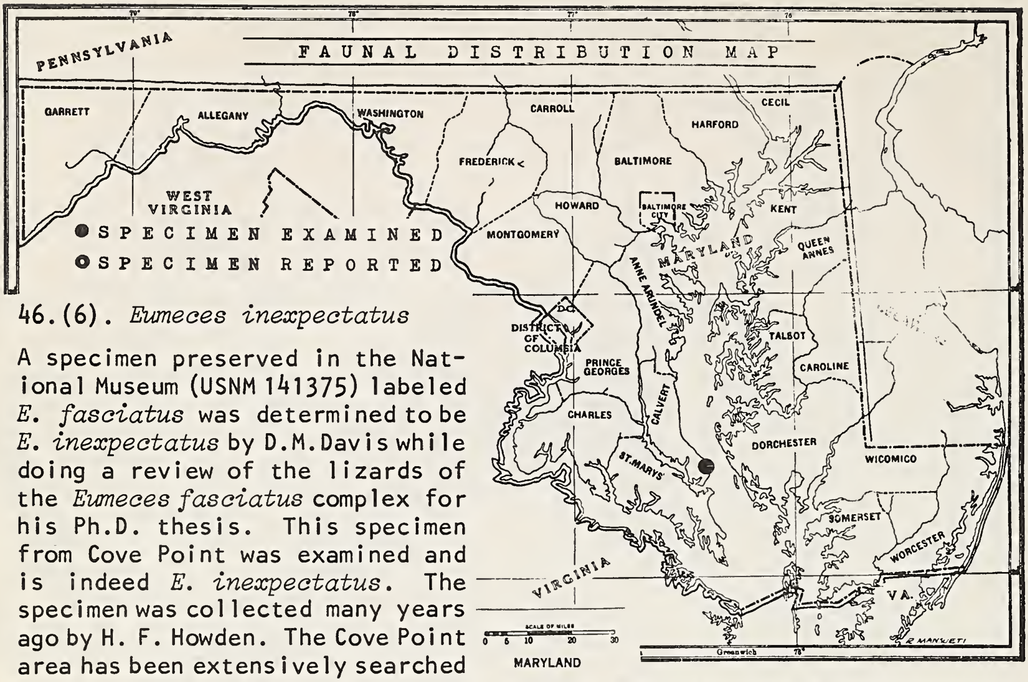
44.(4). *Eumeces a. anthracinus*

Probably restricted to the Alleghany Plateau, (two old specimens in the ANSP collection (9433, 9434), simply labled Allegany County.



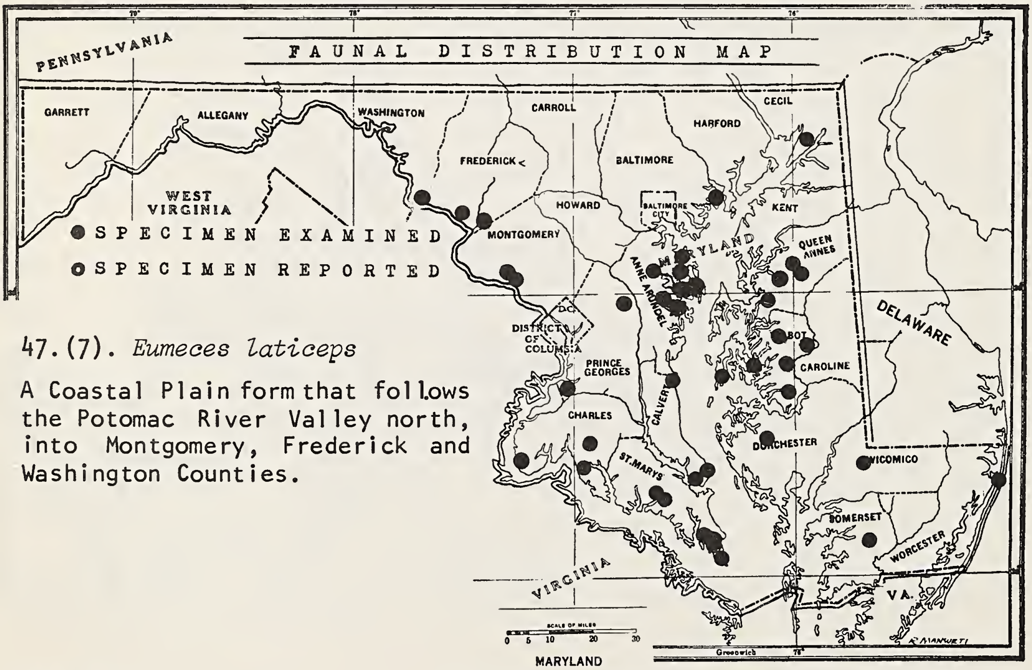
45.(5). *Eumeces fasciatus*

Apparently statewide but extremely rare on the Alleghany Plateau, and rather uncommon above the Fall Line. Specimen examined from Garrett Co., was collected 31 Aug. 1942 at Deep Creek Lake by M. H. Muma.



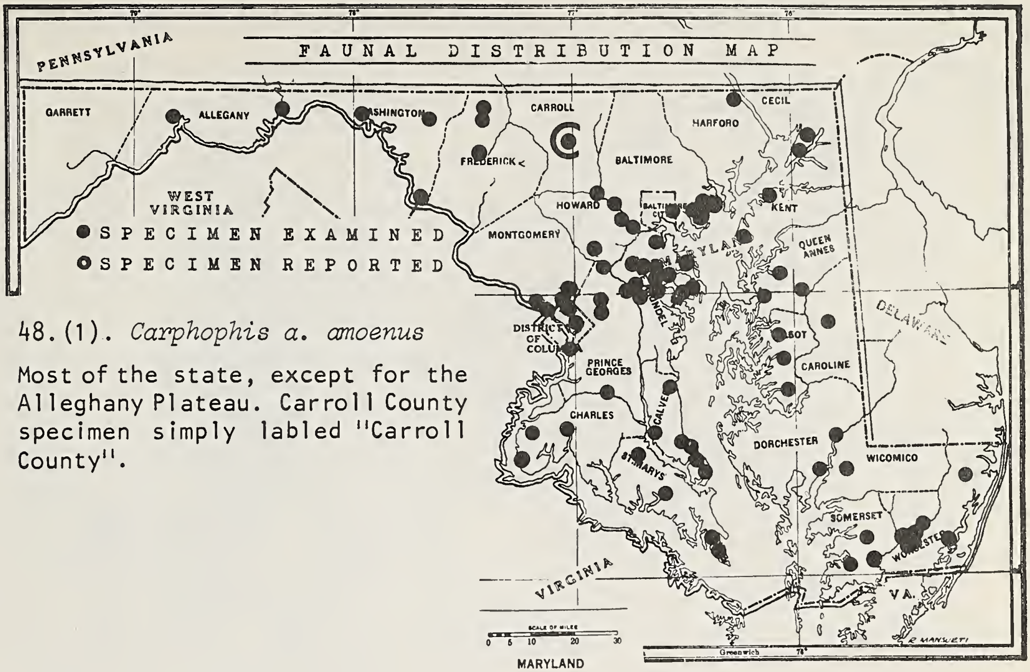
46.(6). *Eumeces inexpectatus*

A specimen preserved in the National Museum (USNM 141375) labeled *E. fasciatus* was determined to be *E. inexpectatus* by D.M.Davis while doing a review of the lizards of the *Eumeces fasciatus* complex for his Ph.D. thesis. This specimen from Cove Point was examined and is indeed *E. inexpectatus*. The specimen was collected many years ago by H. F. Howden. The Cove Point area has been extensively searched and no additional material found. Howden has collected *E. inexpectatus* farther south and kept live material. If perchance *E. fasciatus* from Cove Point was kept together with live *E. inexpectatus* an error could possibly have been made on the death of the specimens. The inclusion of *E. inexpectatus* on the Maryland list of amphibians and reptiles must at this time be considered tenative.



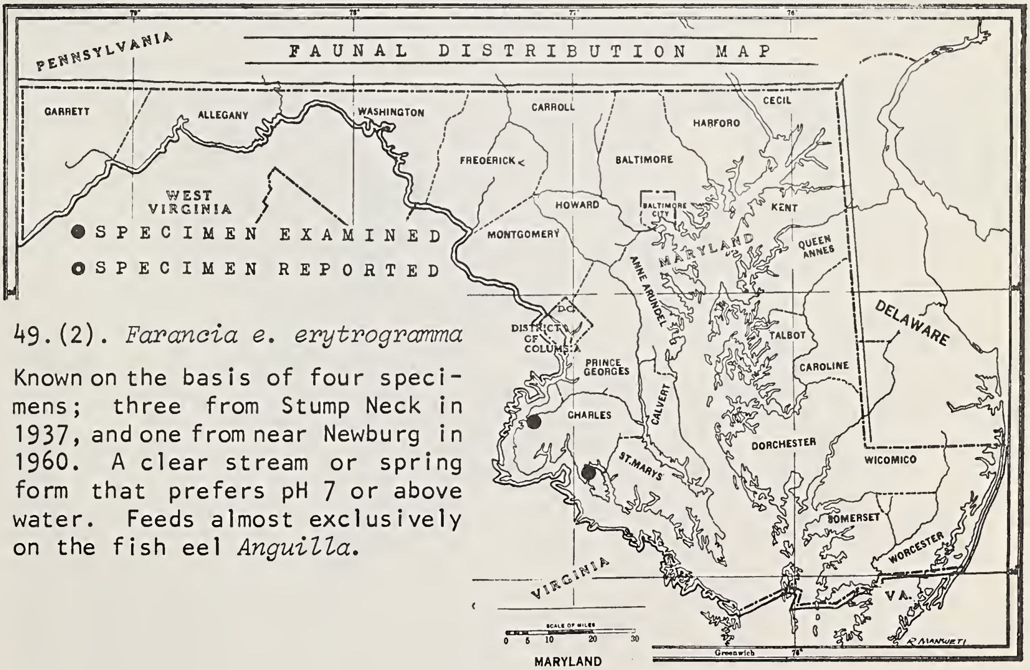
47.(7). *Eumeces laticeps*

A Coastal Plain form that follows the Potomac River Valley north, into Montgomery, Frederick and Washington Counties.



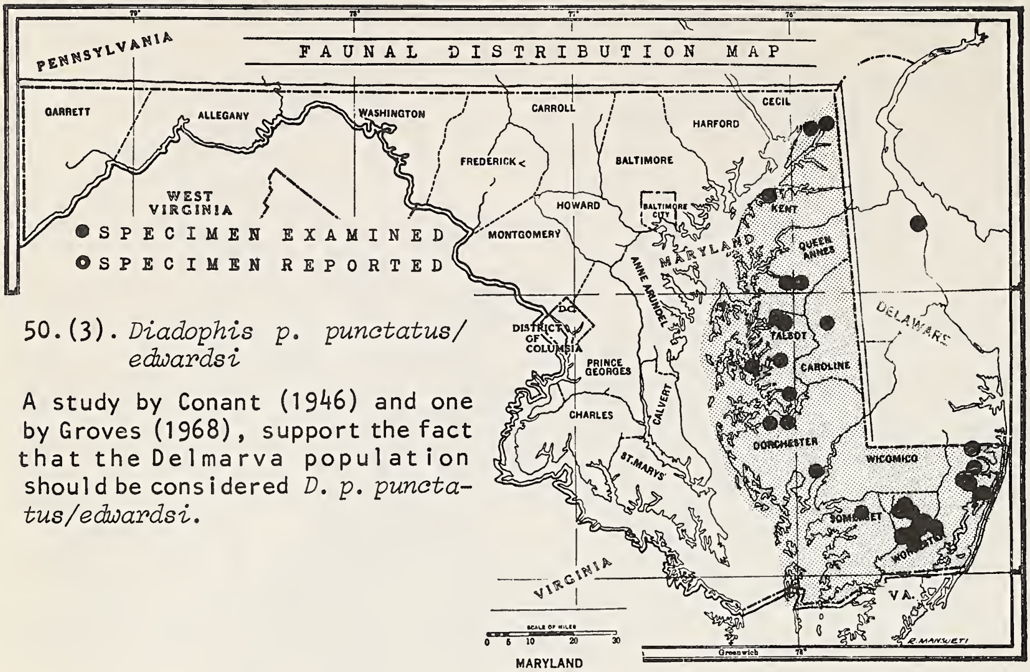
48.(1). *Carphophis a. amoenus*

Most of the state, except for the Alleghany Plateau. Carroll County specimen simply labled "Carroll County".



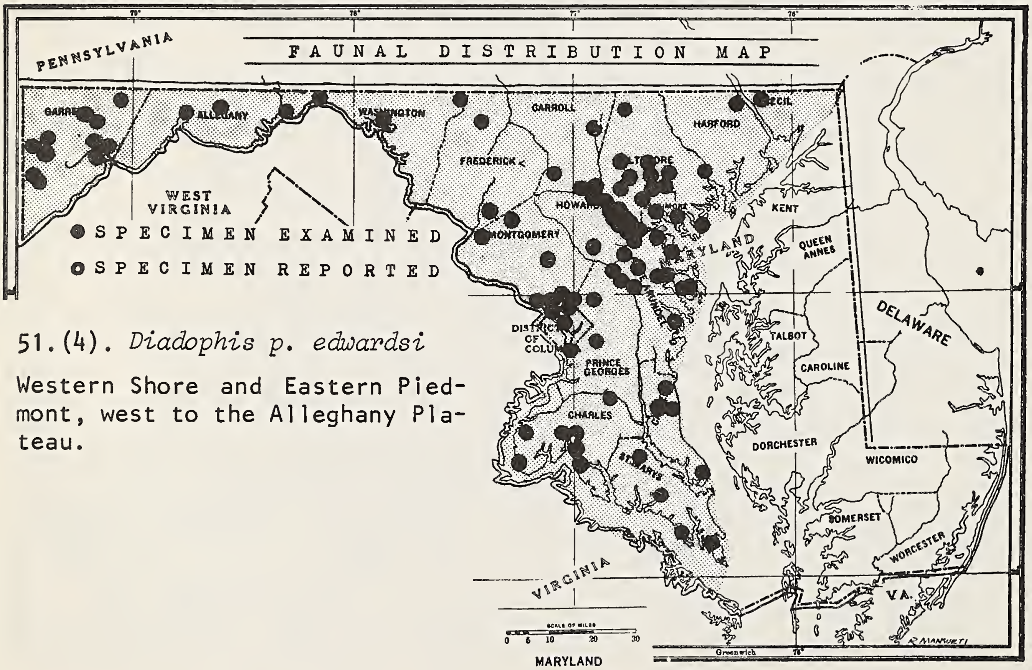
49.(2). *Farancia e. erytrogramma*

Known on the basis of four specimens; three from Stump Neck in 1937, and one from near Newburg in 1960. A clear stream or spring form that prefers pH 7 or above water. Feeds almost exclusively on the fish eel *Anguilla*.



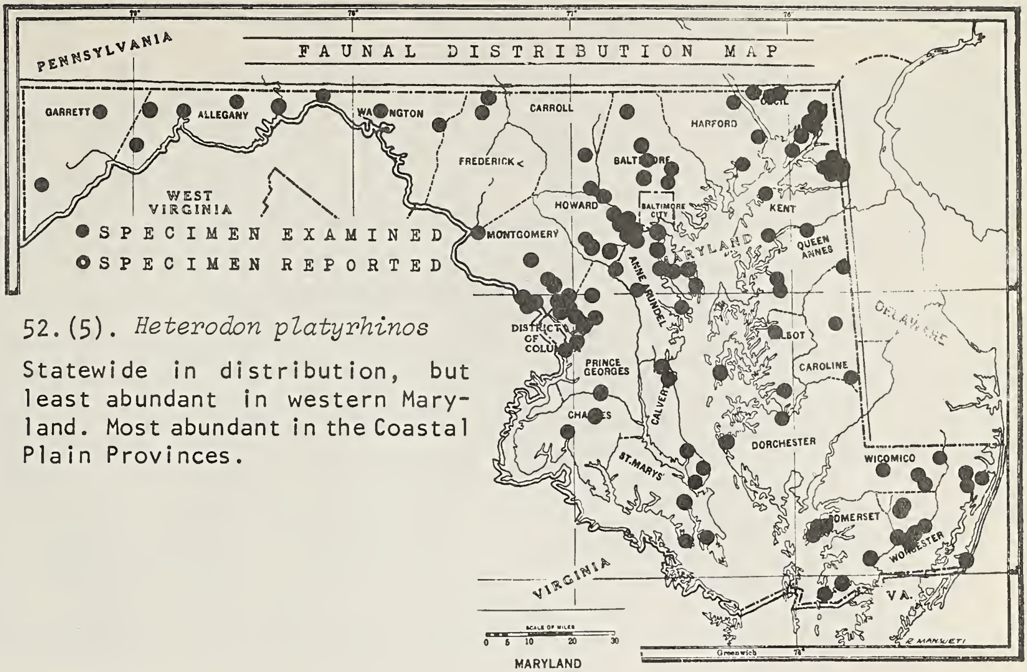
50.(3). *Diadophis p. punctatus/ edwardsi*

A study by Conant (1946) and one by Groves (1968), support the fact that the Delmarva population should be considered *D. p. punctatus/edwardsi*.



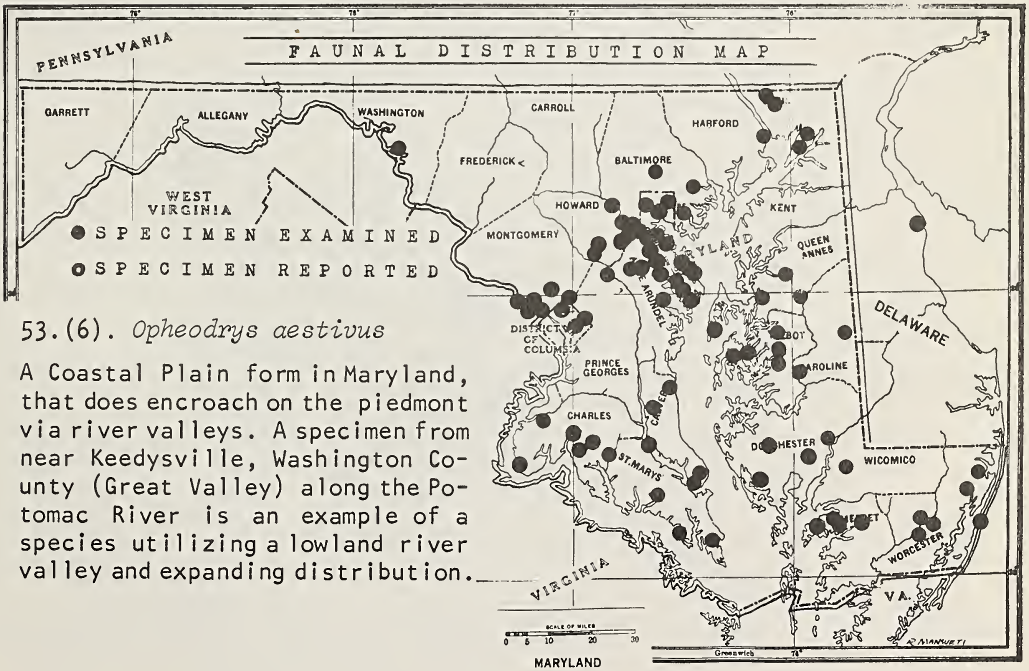
51.(4). *Diadophis p. edwardsi*

Western Shore and Eastern Piedmont, west to the Alleghany Plateau.



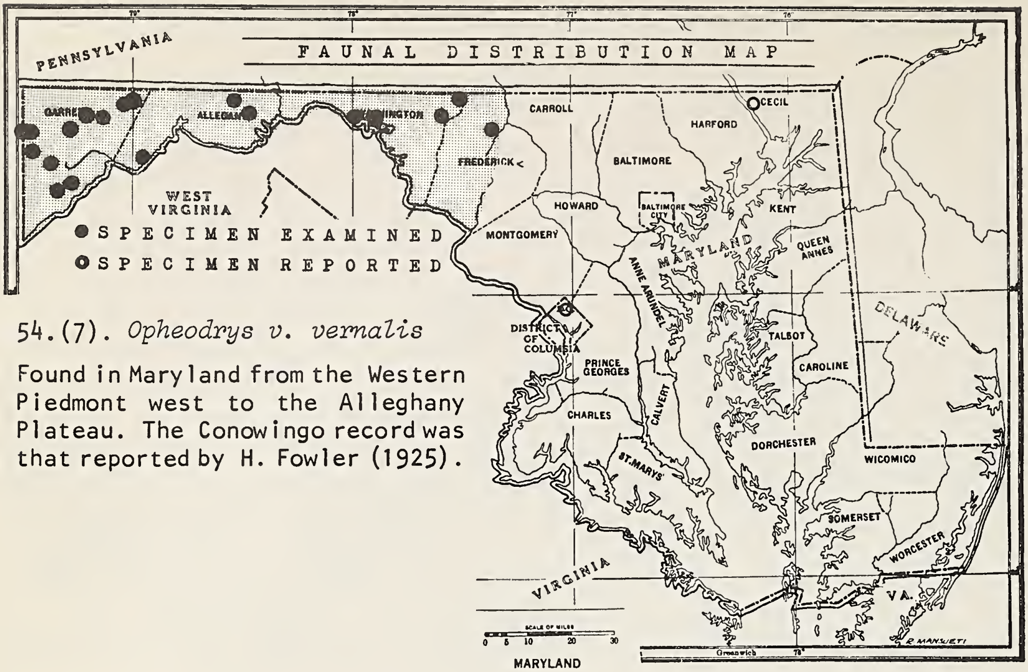
52.(5). *Heterodon platyrhinos*

Statewide in distribution, but least abundant in western Maryland. Most abundant in the Coastal Plain Provinces.



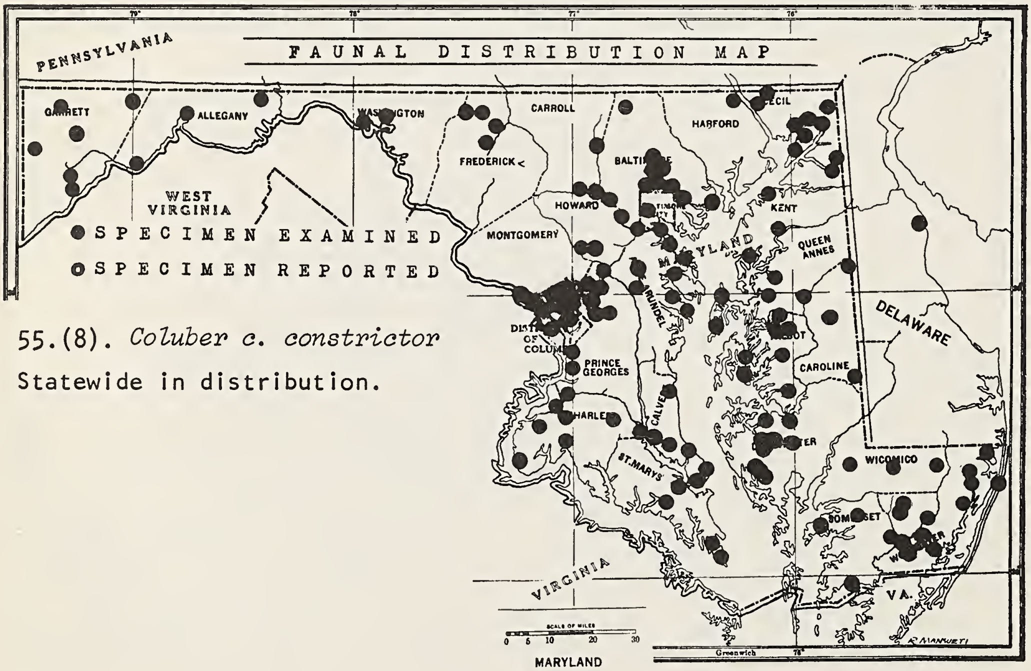
53.(6). *Opheodrys aestivus*

A Coastal Plain form in Maryland, that does encroach on the piedmont via river valleys. A specimen from near Keedysville, Washington County (Great Valley) along the Potomac River is an example of a species utilizing a lowland river valley and expanding distribution.



54.(7). *Opheodrys v. vernalis*

Found in Maryland from the Western Piedmont west to the Alleghany Plateau. The Conowingo record was that reported by H. Fowler (1925).

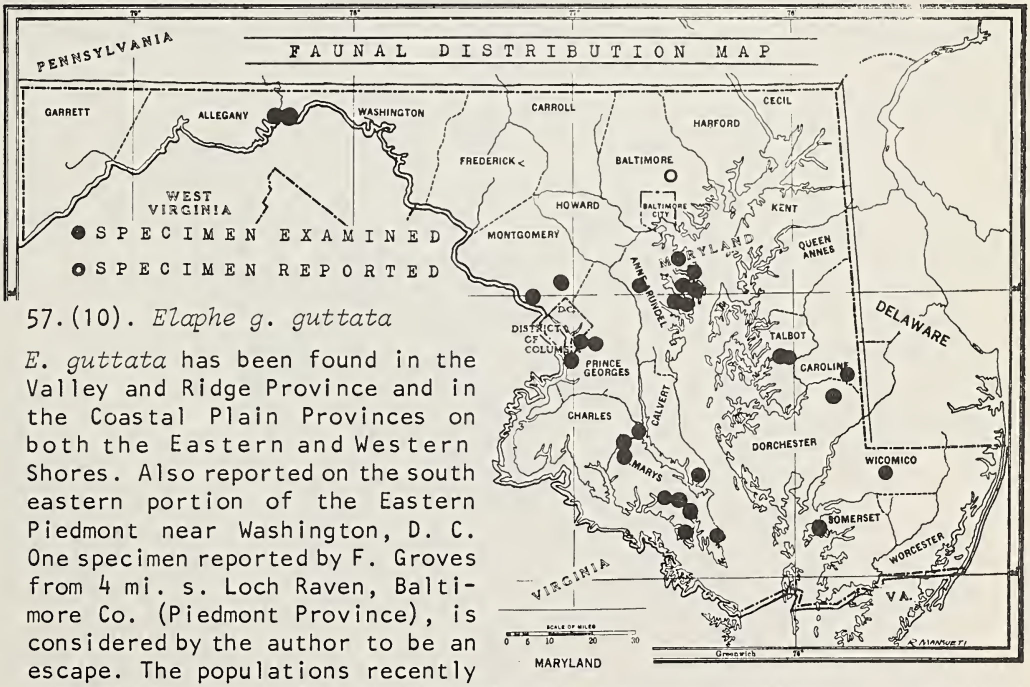


55.(8). *Coluber c. constrictor*

Statewide in distribution.

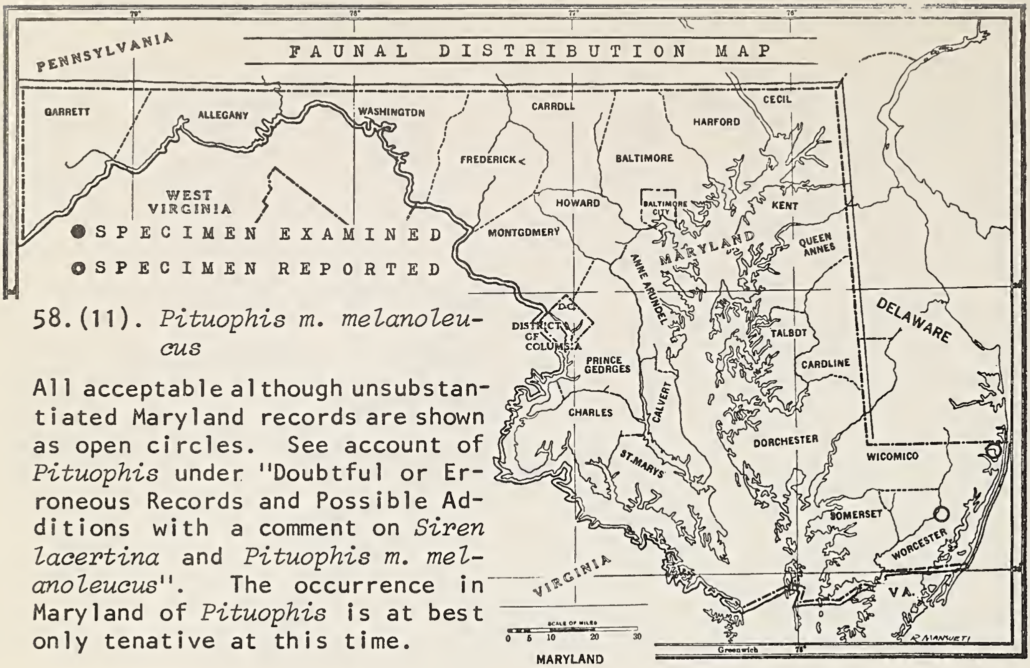
56.(9). *Elaphe o. obsoleta*

Statewide in distribution.



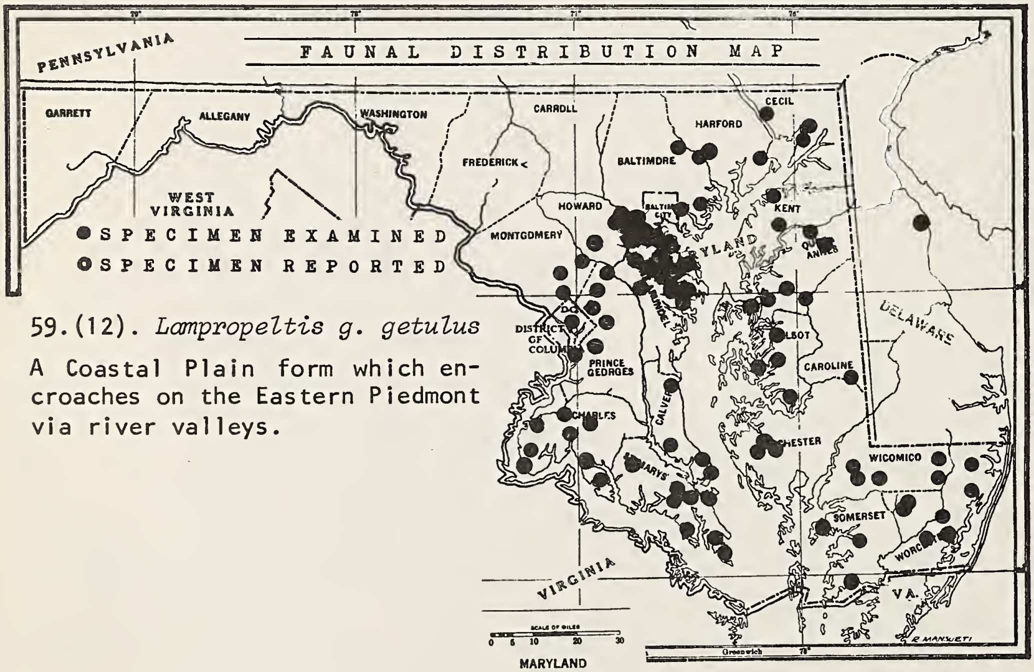
57.(10). *Elaphe g. guttata*

E. guttata has been found in the Valley and Ridge Province and in the Coastal Plain Provinces on both the Eastern and Western Shores. Also reported on the south eastern portion of the Eastern Piedmont near Washington, D. C. One specimen reported by F. Groves from 4 mi. s. Loch Raven, Baltimore Co. (Piedmont Province), is considered by the author to be an escape. The populations recently reported from the Valley and Ridge Province are not contingent in Maryland with the Coastal Plain populations.



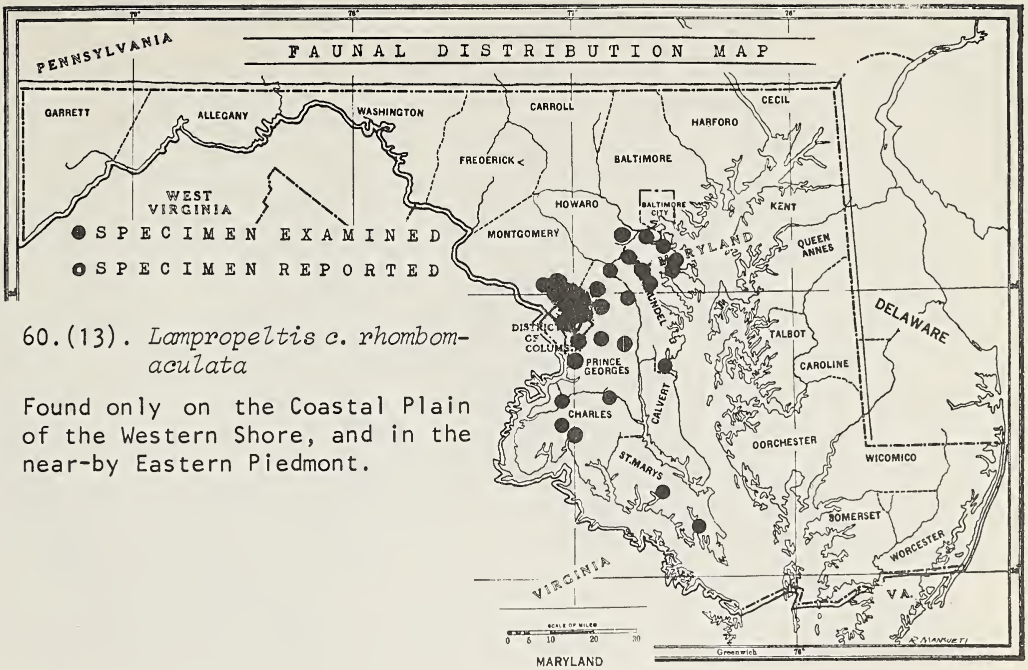
58.(11). *Pituophis m. melanoleucus*

All acceptable although unsubstantiated Maryland records are shown as open circles. See account of *Pituophis* under "Doubtful or Erroneous Records and Possible Additions with a comment on *Siren lacertina* and *Pituophis m. melanoleucus*". The occurrence in Maryland of *Pituophis* is at best only tenative at this time.



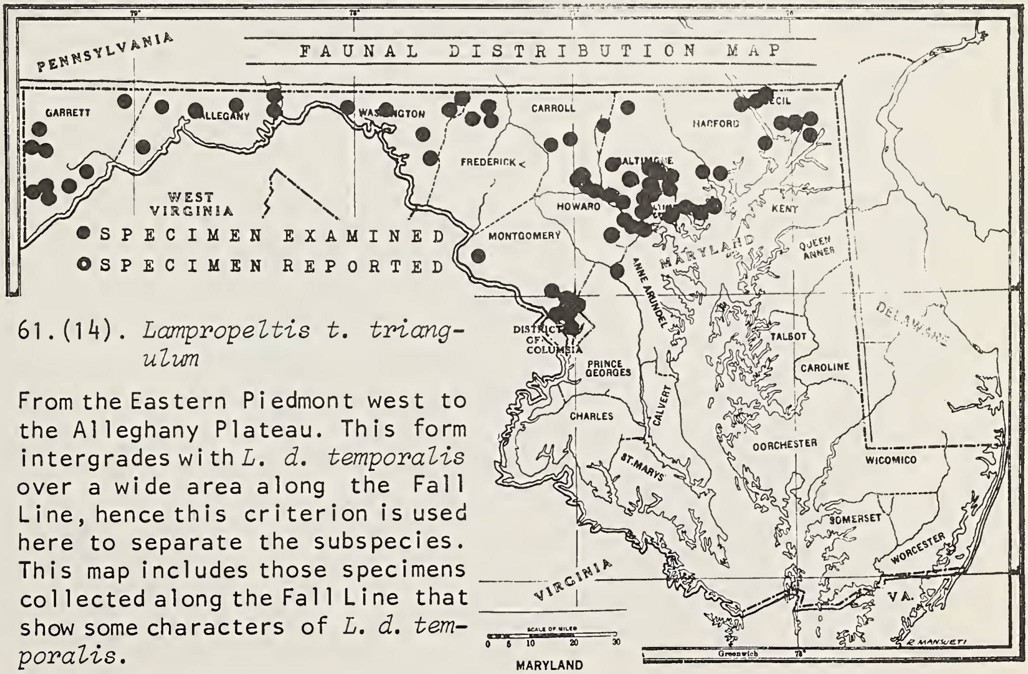
59.(12). *Lampropeltis g. getulus*

A Coastal Plain form which encroaches on the Eastern Piedmont via river valleys.



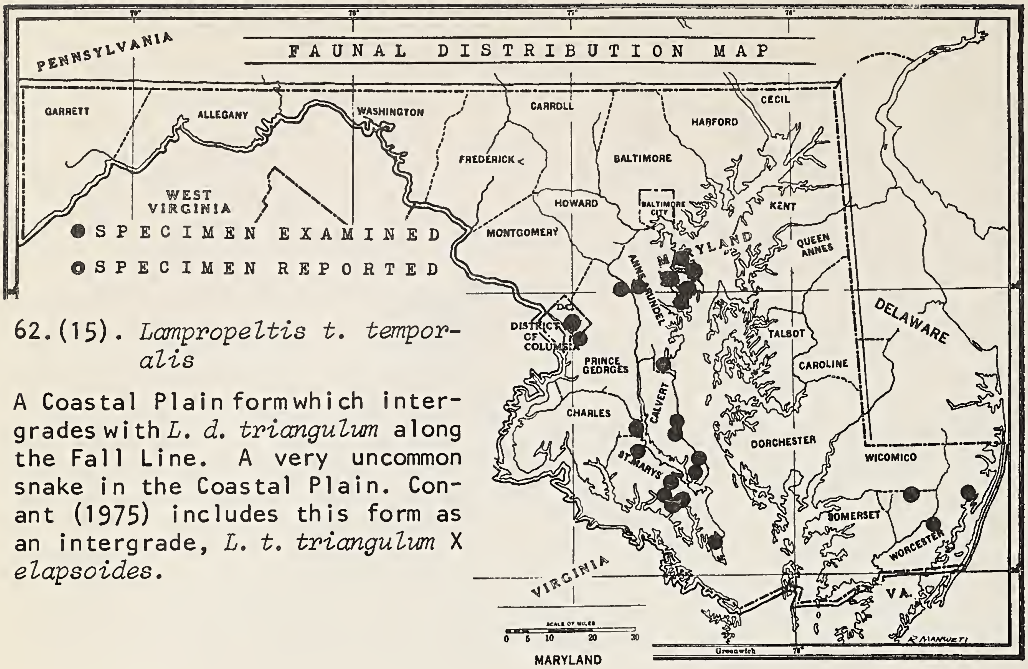
60.(13). *Lampropeltis c. rhombomaculata*

Found only on the Coastal Plain of the Western Shore, and in the near-by Eastern Piedmont.



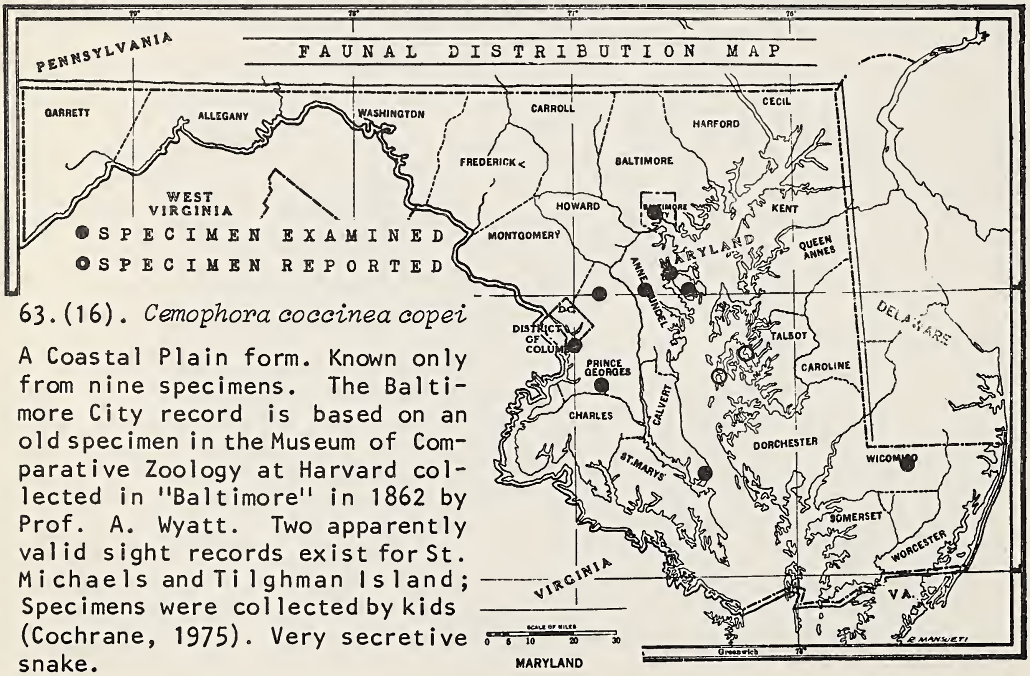
61.(14). *Lampropeltis t. triangulum*

From the Eastern Piedmont west to the Alleghany Plateau. This form intergrades with *L. d. temporalis* over a wide area along the Fall Line, hence this criterion is used here to separate the subspecies. This map includes those specimens collected along the Fall Line that show some characters of *L. d. temporalis*.



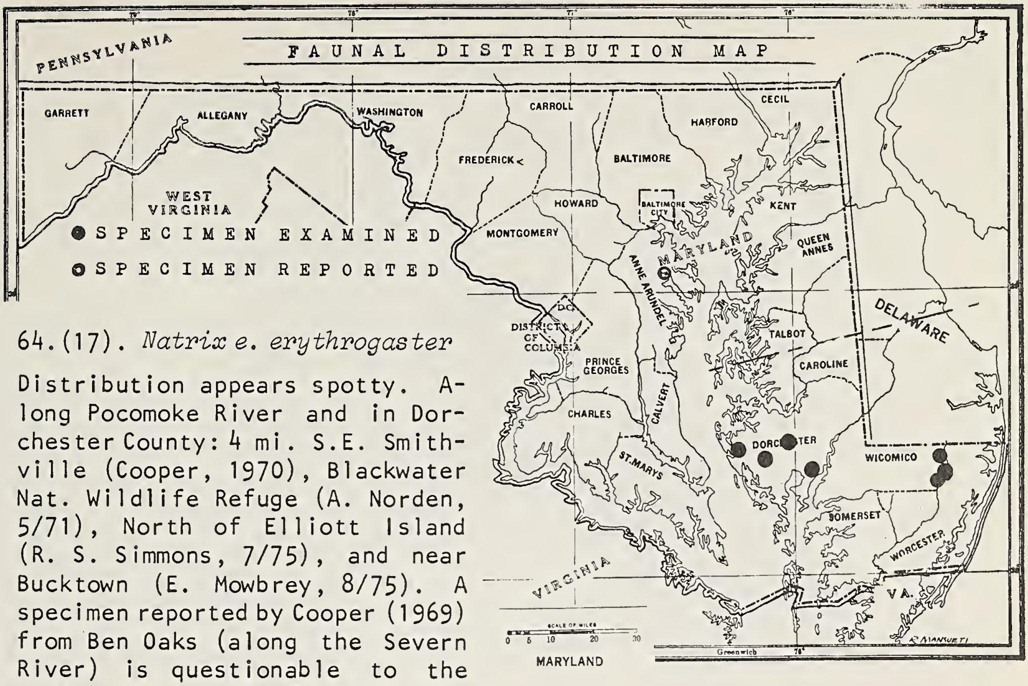
62.(15). *Lampropeltis t. temporalis*

A Coastal Plain form which intergrades with *L. d. triangulum* along the Fall Line. A very uncommon snake in the Coastal Plain. Conant (1975) includes this form as an intergrade, *L. t. triangulum* X *elapsoides*.



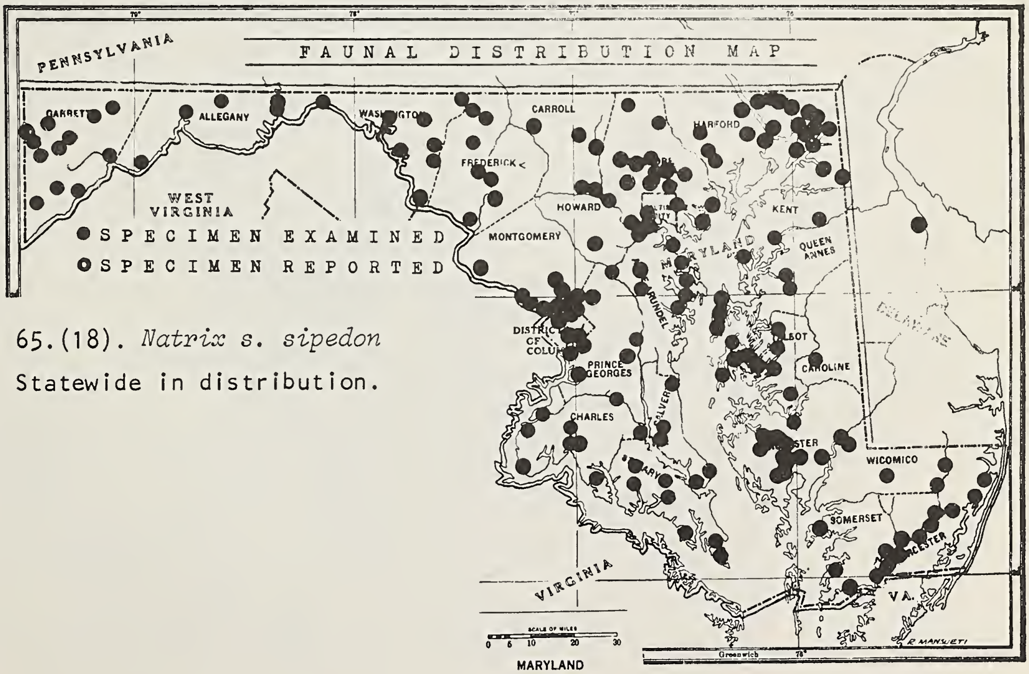
63.(16). *Cemophora coccinea copei*

A Coastal Plain form. Known only from nine specimens. The Baltimore City record is based on an old specimen in the Museum of Comparative Zoology at Harvard collected in "Baltimore" in 1862 by Prof. A. Wyatt. Two apparently valid sight records exist for St. Michaels and Tilghman Island; Specimens were collected by kids (Cochrane, 1975). Very secretive snake.



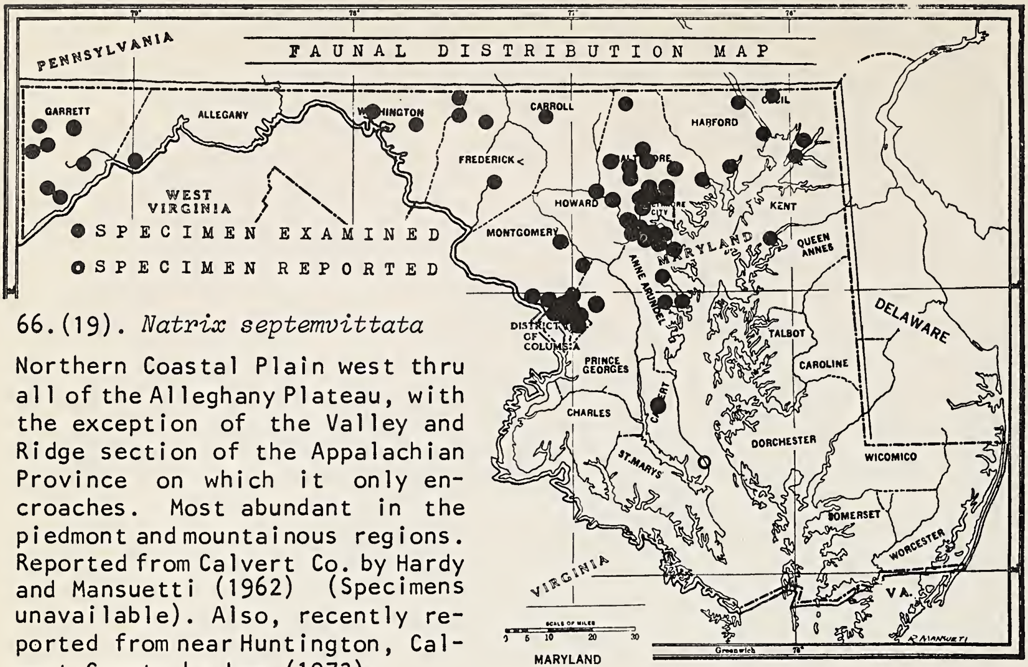
64.(17). *Natrix e. erythrogaster*

Distribution appears spotty. Along Pocomoke River and in Dorchester County: 4 mi. S.E. Smithville (Cooper, 1970), Blackwater Nat. Wildlife Refuge (A. Norden, 5/71), North of Elliott Island (R. S. Simmons, 7/75), and near Bucktown (E. Mowbrey, 8/75). A specimen reported by Cooper (1969) from Ben Oaks (along the Severn River) is questionable to the author.



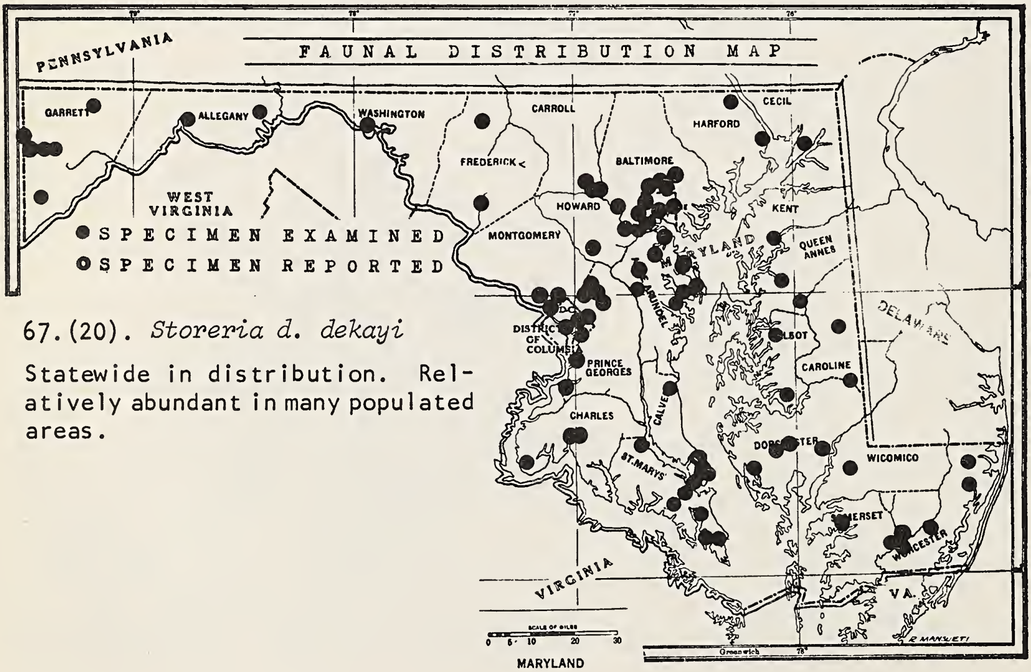
65.(18). *Natrix s. sipedon*

Statewide in distribution.



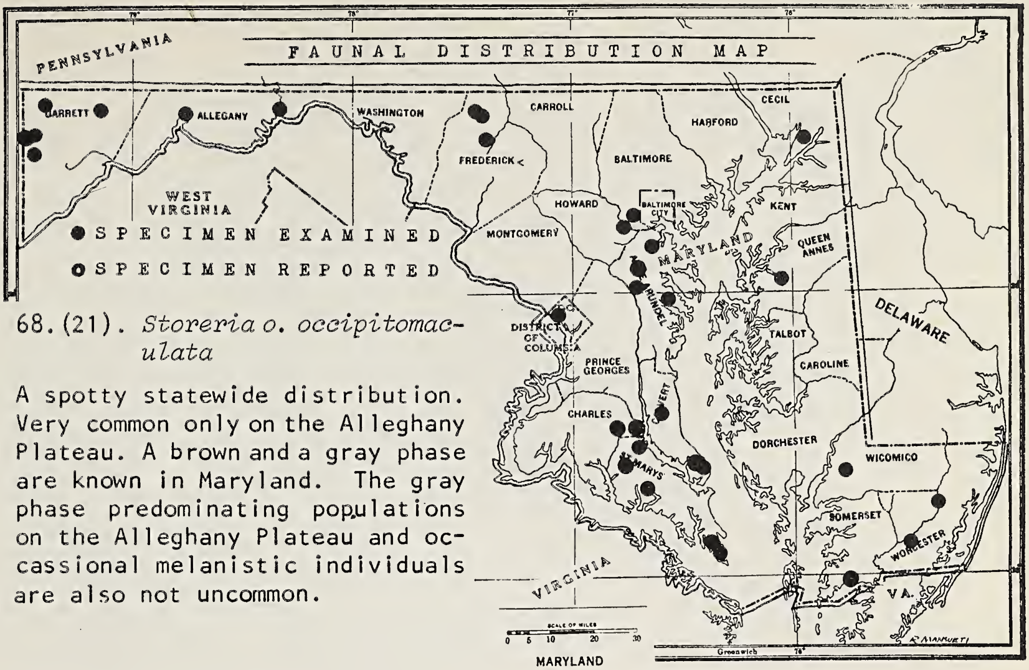
66.(19). *Natrix septemvittata*

Northern Coastal Plain west thru all of the Alleghany Plateau, with the exception of the Valley and Ridge section of the Appalachian Province on which it only encroaches. Most abundant in the piedmont and mountainous regions. Reported from Calvert Co. by Hardy and Mansuetti (1962) (Specimens unavailable). Also, recently reported from near Huntington, Calvert County by Lee (1973).



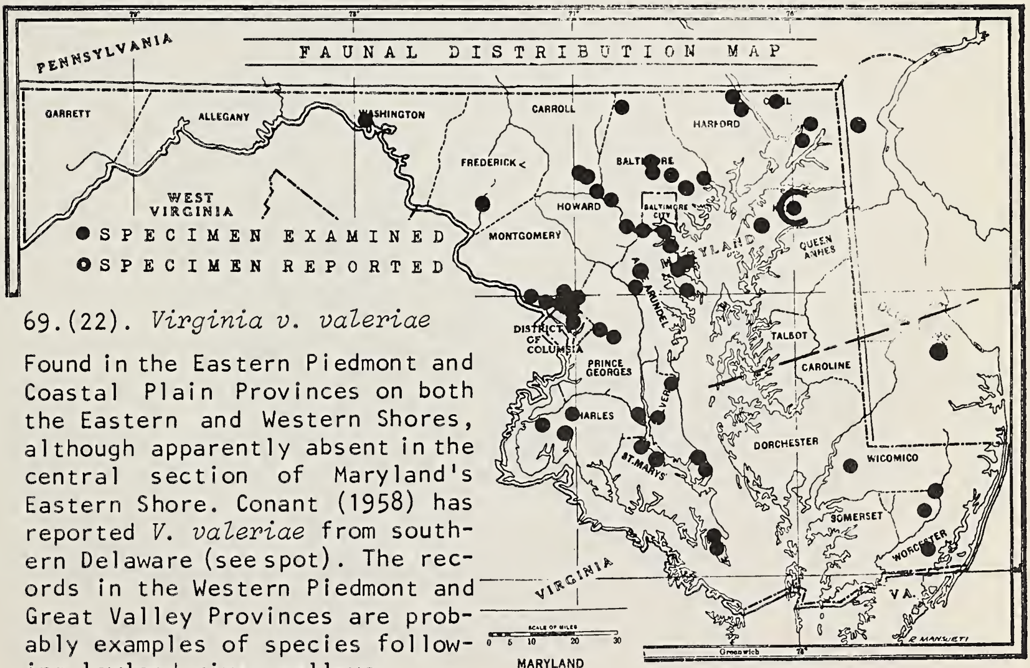
67.(20). *Storeria d. dekayi*

Statewide in distribution. Relatively abundant in many populated areas.



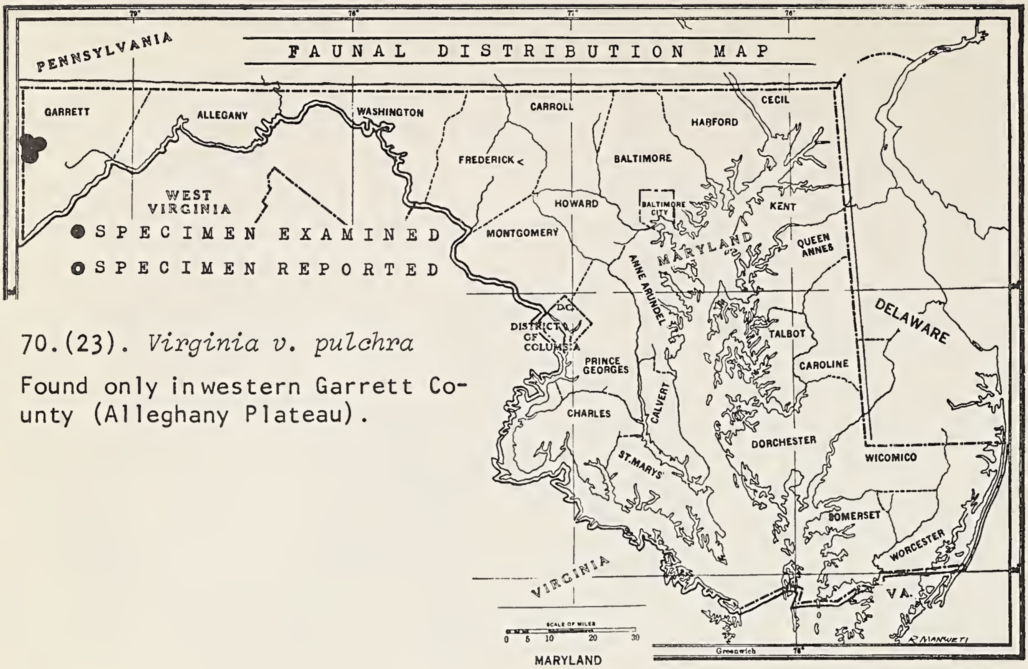
68.(21). *Storeria o. occipitomaculata*

A spotty statewide distribution. Very common only on the Alleghany Plateau. A brown and a gray phase are known in Maryland. The gray phase predominating populations on the Alleghany Plateau and occassional melanistic individuals are also not uncommon.



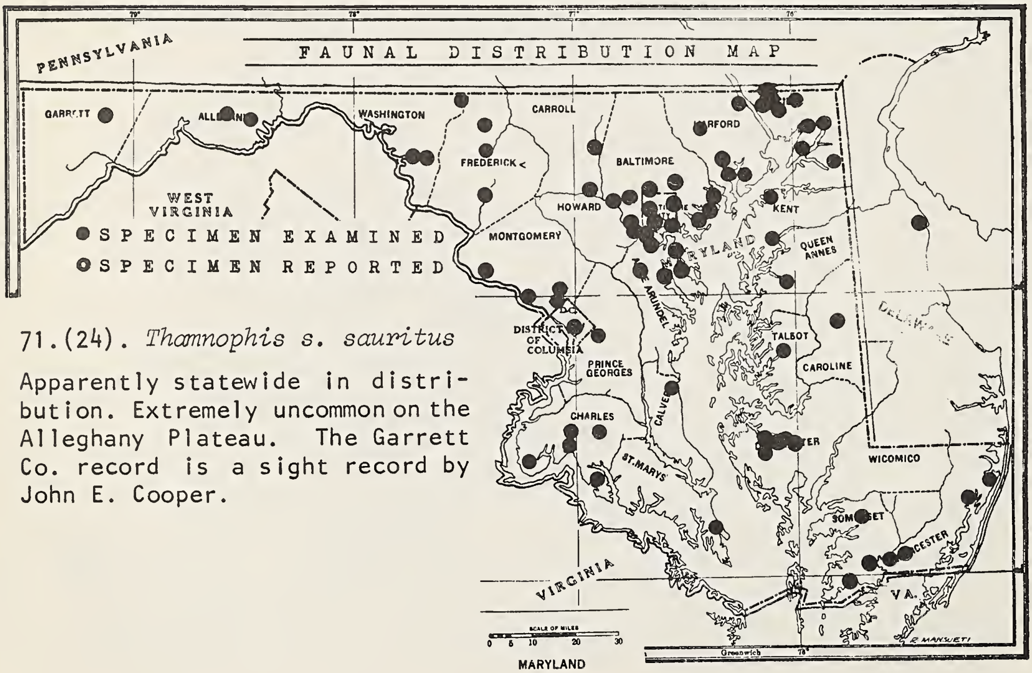
69.(22). *Virginia v. valeriae*

Found in the Eastern Piedmont and Coastal Plain Provinces on both the Eastern and Western Shores, although apparently absent in the central section of Maryland's Eastern Shore. Conant (1958) has reported *V. valeriae* from southern Delaware (see spot). The records in the Western Piedmont and Great Valley Provinces are probably examples of species following lowland river valleys.



70.(23). *Virginia v. pulchra*

Found only in western Garrett County (Alleghany Plateau).

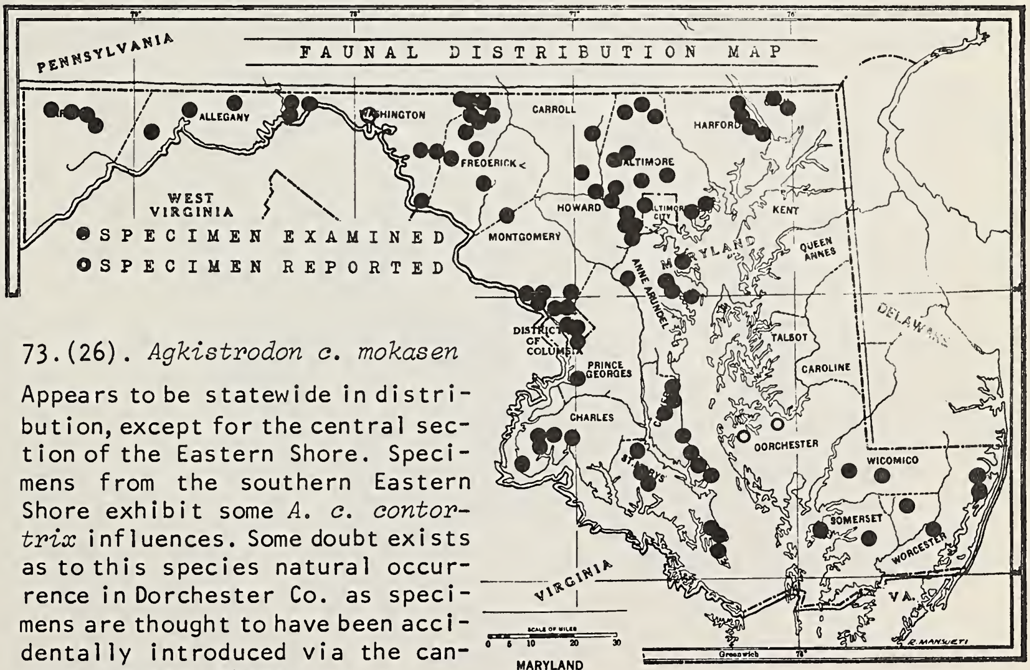


71.(24). *Thamnophis s. sauritus*

Apparently statewide in distribution. Extremely uncommon on the Alleghany Plateau. The Garrett Co. record is a sight record by John E. Cooper.

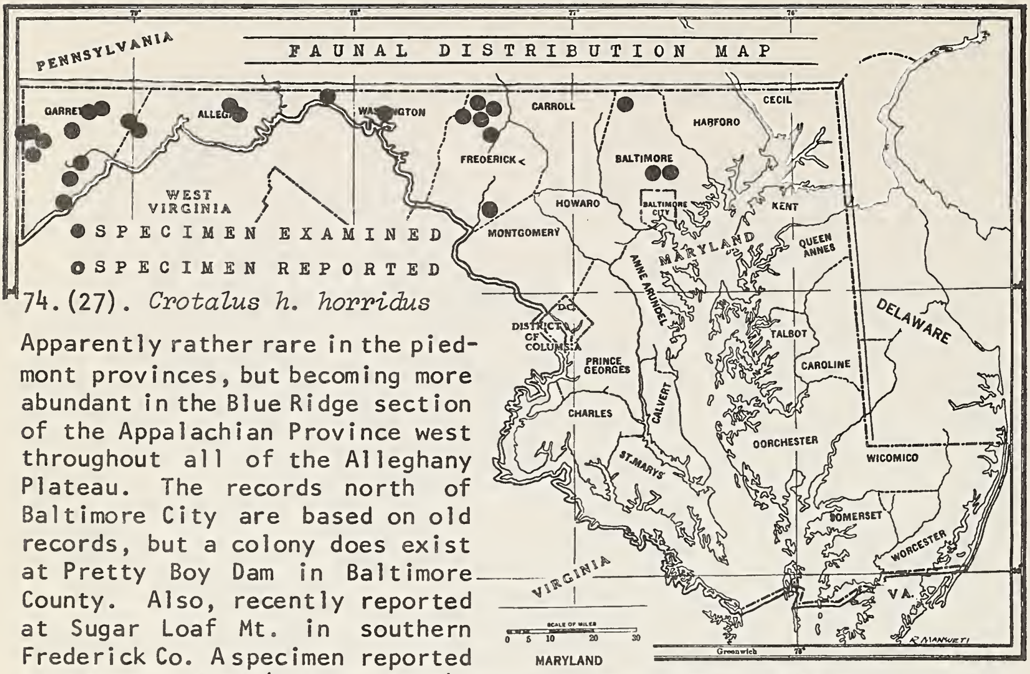
72.(25). *Thamnophis s. sirtalis*

Apparently statewide in distribution.



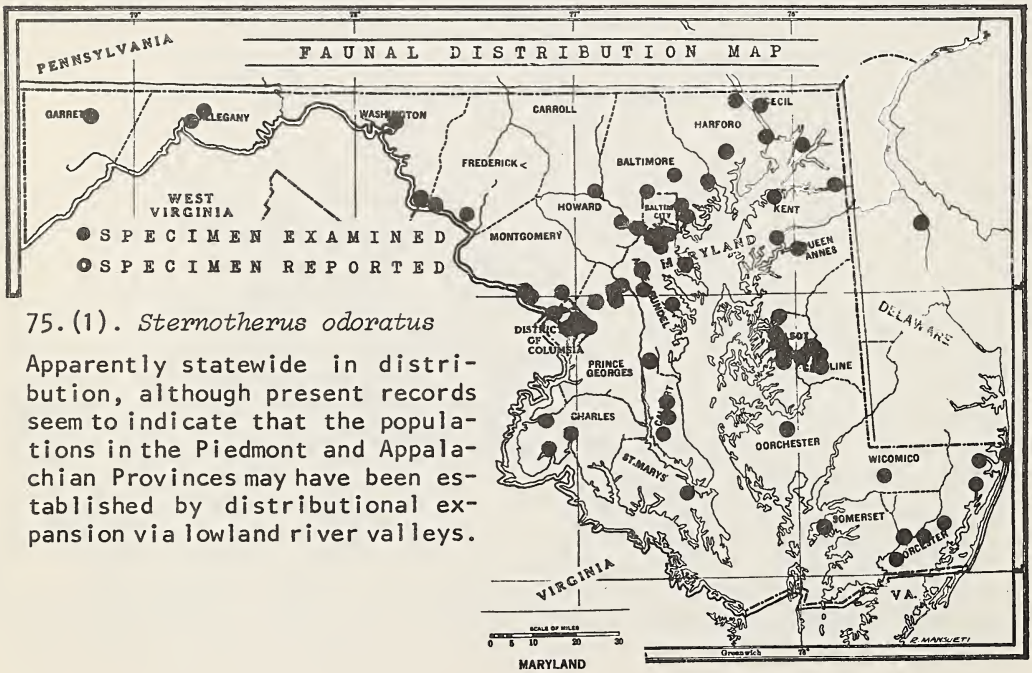
73.(26). *Agkistrodon c. mokasen*

Appears to be statewide in distribution, except for the central section of the Eastern Shore. Specimens from the southern Eastern Shore exhibit some *A. c. contortrix* influences. Some doubt exists as to this species natural occurrence in Dorchester Co. as specimens are thought to have been accidentally introduced via the canning industry there.



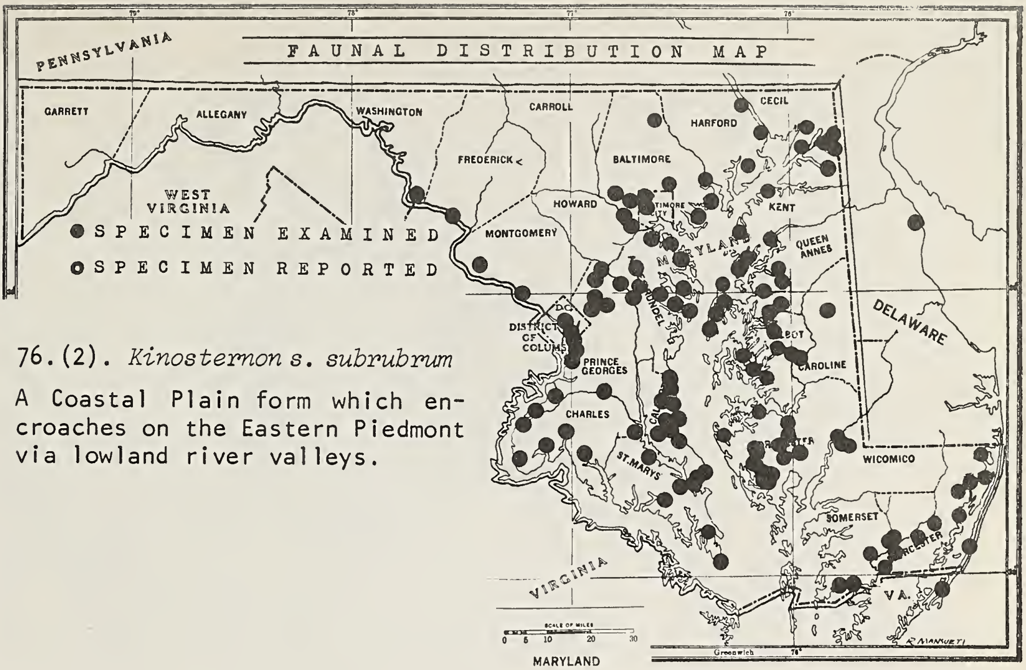
74.(27). *Crotalus h. horridus*

Apparently rather rare in the piedmont provinces, but becoming more abundant in the Blue Ridge section of the Appalachian Province west throughout all of the Alleghany Plateau. The records north of Baltimore City are based on old records, but a colony does exist at Pretty Boy Dam in Baltimore County. Also, recently reported at Sugar Loaf Mt. in southern Frederick Co. A specimen reported from Kent Island (Cooper, 1959) was actually collected in Pennsylvania, and a specimen recently found in northern Anne Arundel Co. just after a severe storm (Agnes, 1972) was probably washed down during the flooding, or represents a release.



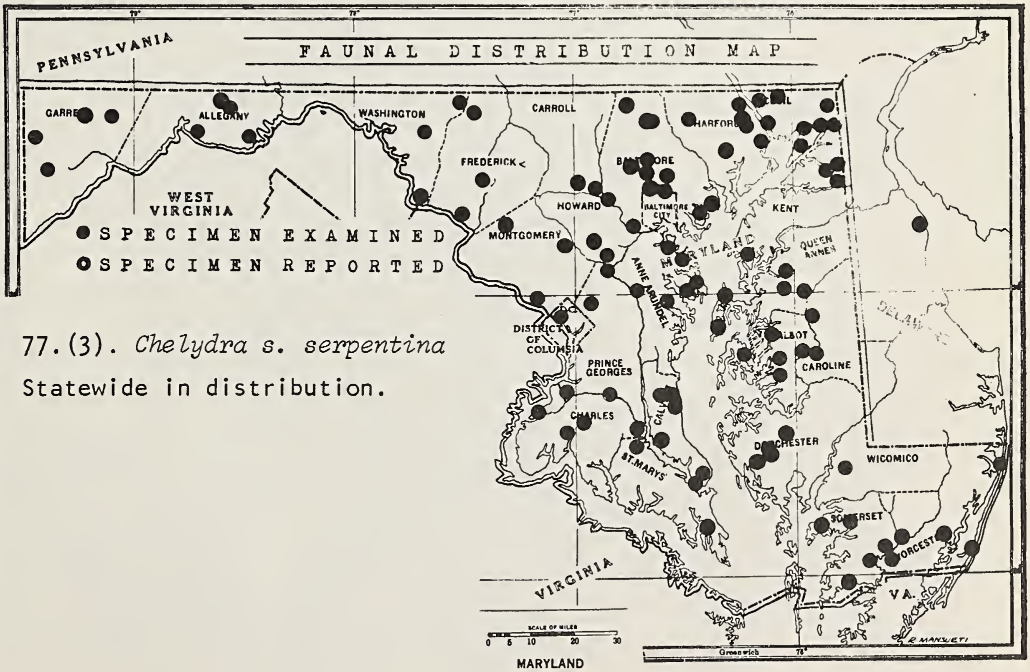
75.(1). *Sternotherus odoratus*

Apparently statewide in distribution, although present records seem to indicate that the populations in the Piedmont and Appalachian Provinces may have been established by distributional expansion via lowland river valleys.



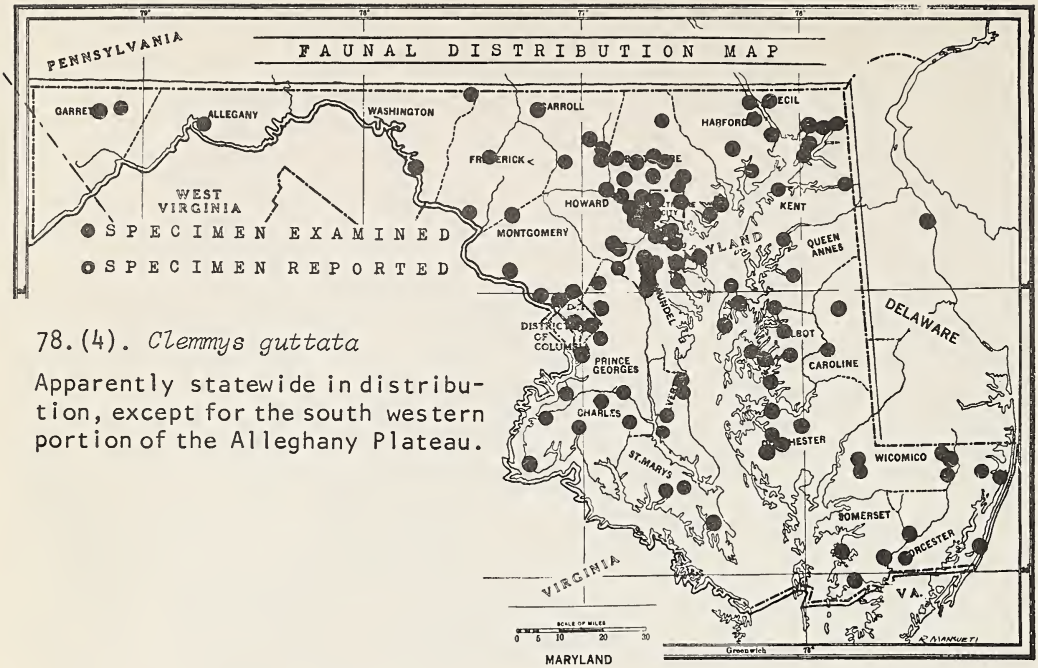
76.(2). *Kinosternon s. subrubrum*

A Coastal Plain form which encroaches on the Eastern Piedmont via lowland river valleys.



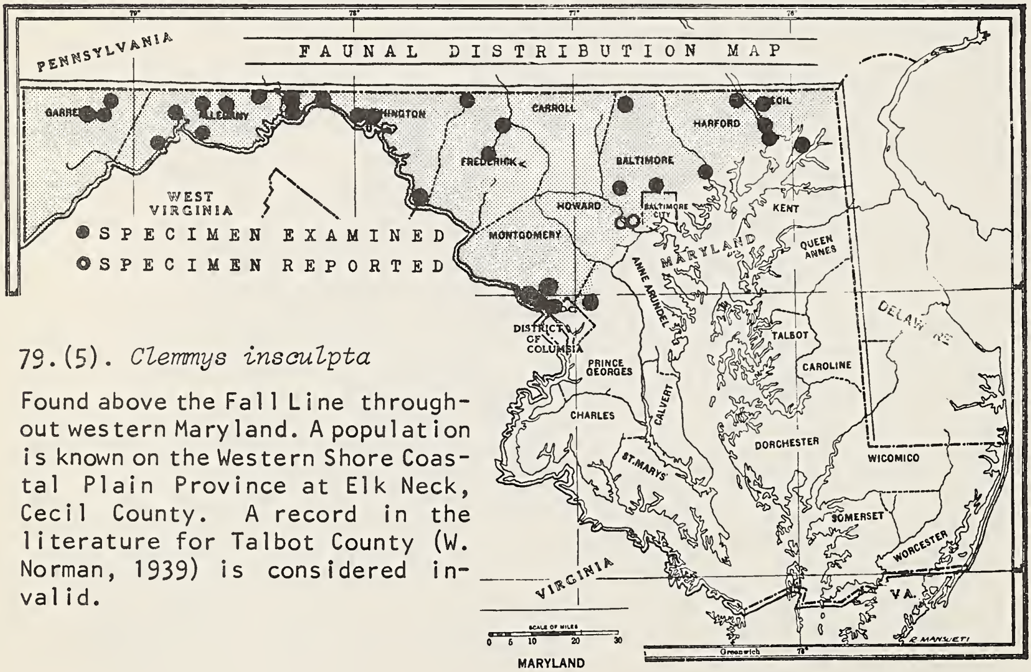
77.(3). *Chelydra s. serpentina*

Statewide in distribution.



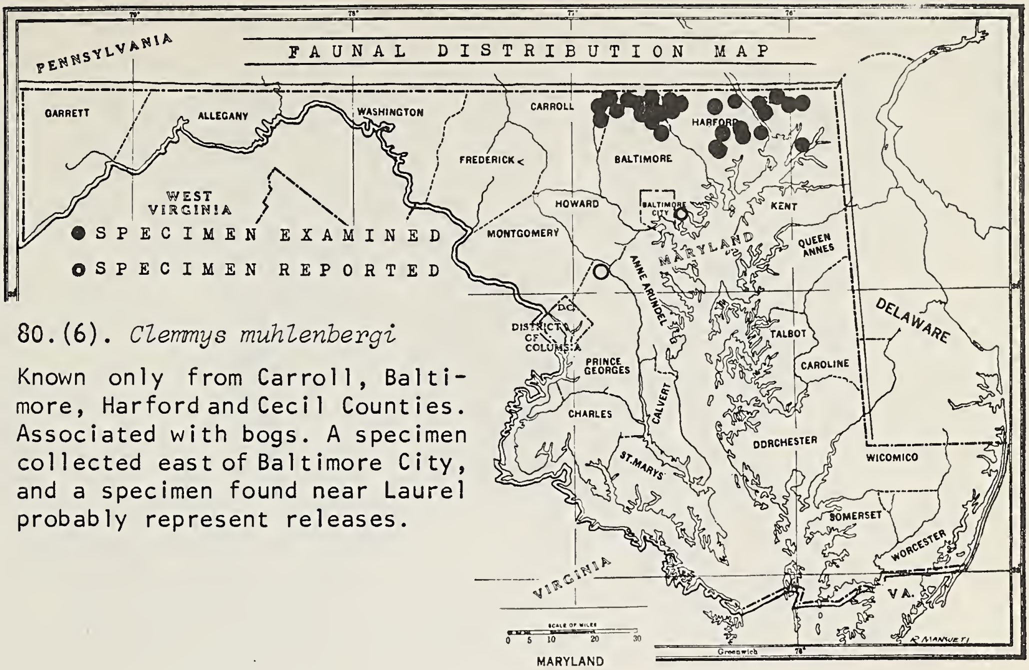
78.(4). *Clemmys guttata*

Apparently statewide in distribution, except for the south western portion of the Alleghany Plateau.



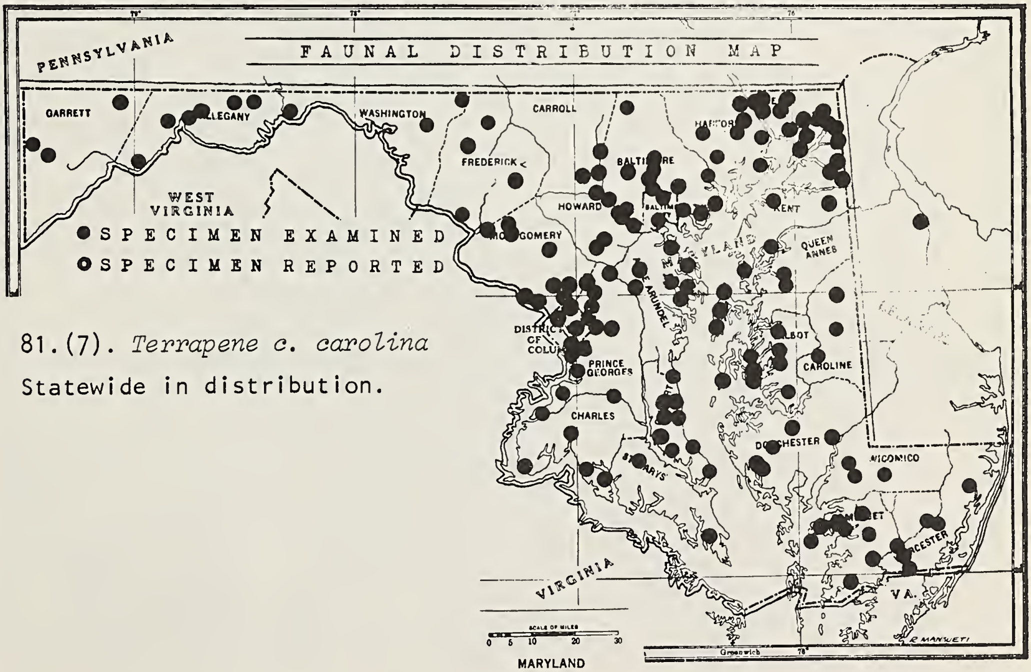
79.(5). *Clemmys insculpta*

Found above the Fall Line throughout western Maryland. A population is known on the Western Shore Coastal Plain Province at Elk Neck, Cecil County. A record in the literature for Talbot County (W. Norman, 1939) is considered invalid.



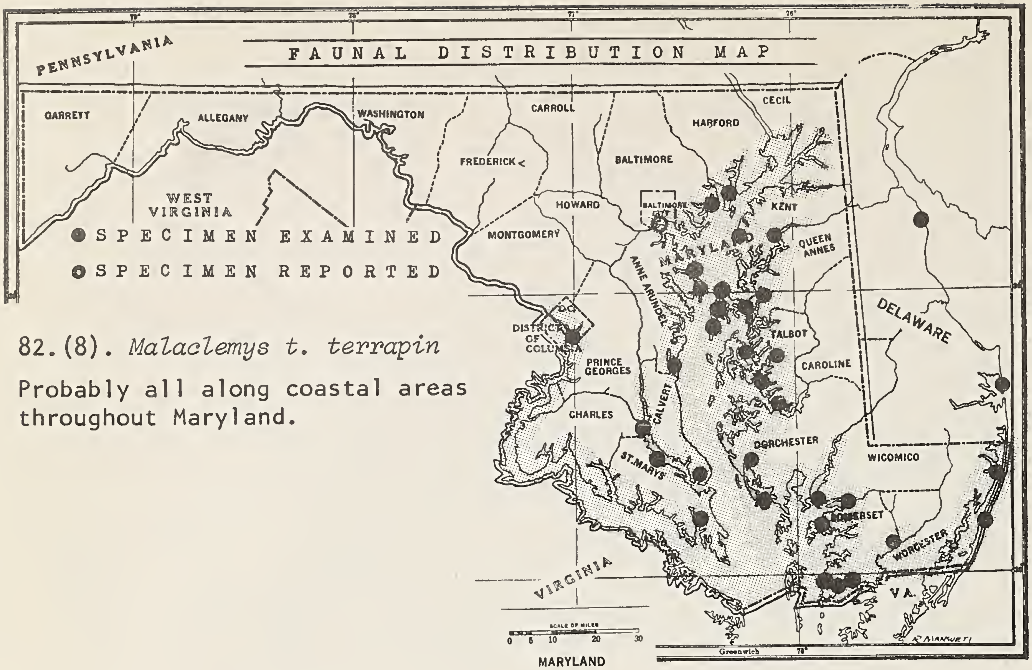
80.(6). *Clemmys muhlenbergi*

Known only from Carroll, Baltimore, Harford and Cecil Counties. Associated with bogs. A specimen collected east of Baltimore City, and a specimen found near Laurel probably represent releases.



81.(7). *Terrapene c. carolina*

Statewide in distribution.

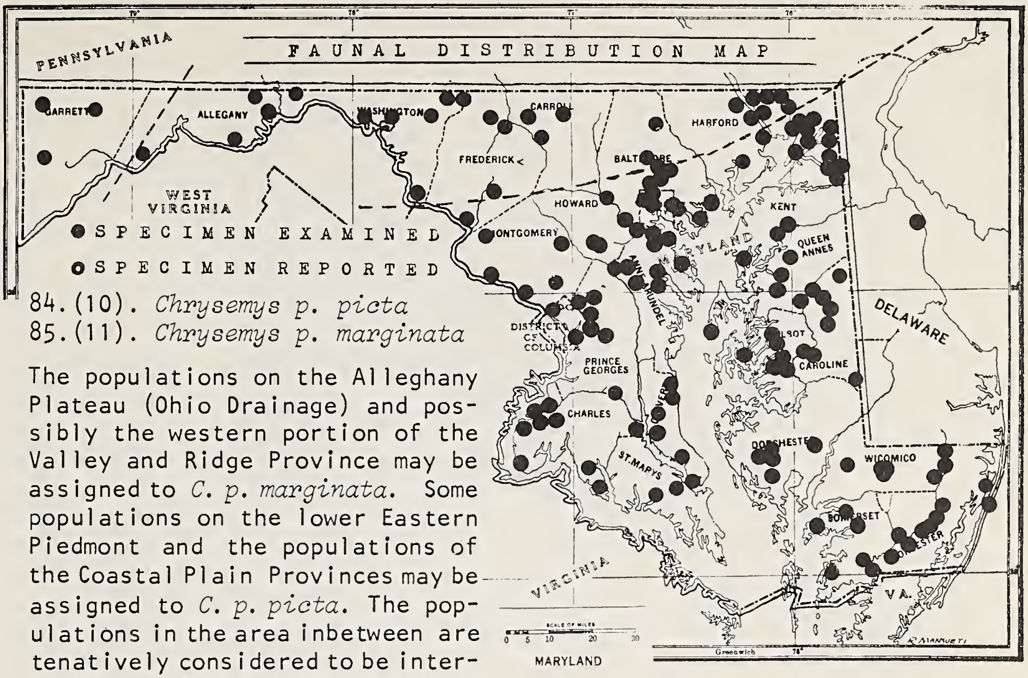


82.(8). *Malaclemys t. terrapin*

Probably all along coastal areas throughout Maryland.

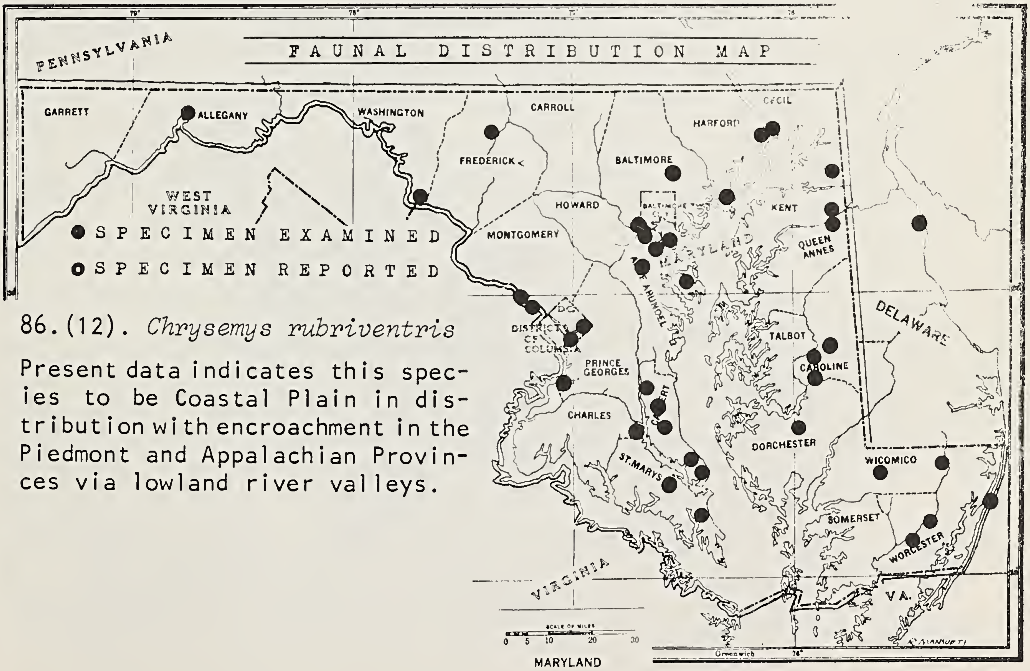
83.(9). *Graptemys geographica*

Known in Harford and Cecil Counties via Susquehanna River.



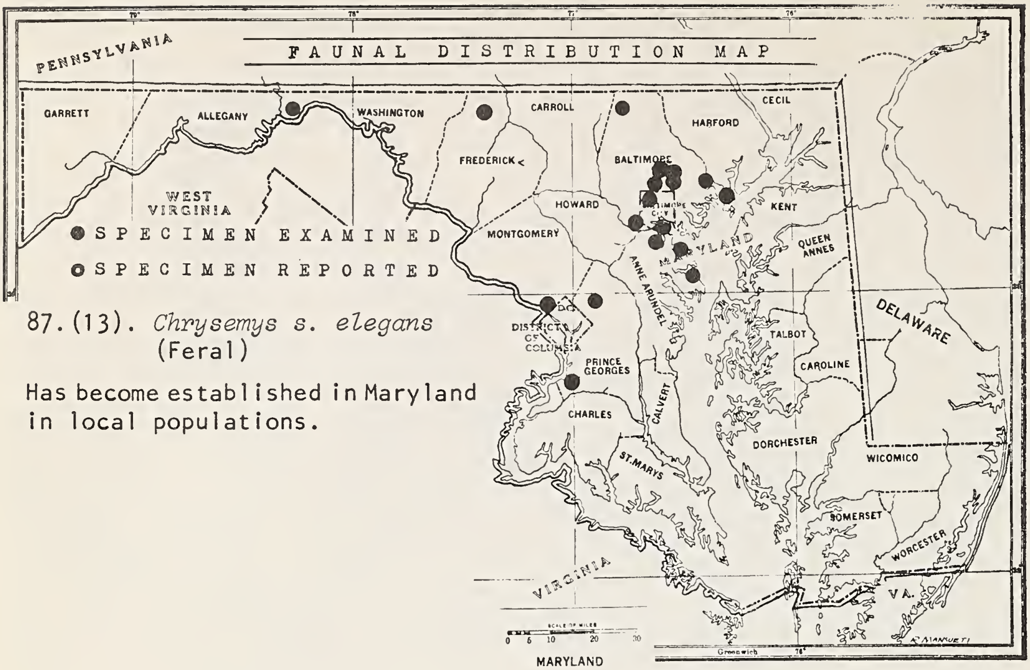
84.(10). *Chrysemys p. picta*
85.(11). *Chrysemys p. marginata*

The populations on the Alleghany Plateau (Ohio Drainage) and possibly the western portion of the Valley and Ridge Province may be assigned to *C. p. marginata*. Some populations on the lower Eastern Piedmont and the populations of the Coastal Plain Provinces may be assigned to *C. p. picta*. The populations in the area inbetween are tenatively considered to be intergrade populations. See Hartman (1958) Pough & Pough, (1968) for additional information. On the county distribution and physiographic distribution tables, the intergrade populations will be included in the distribution of *C. p. picta*.



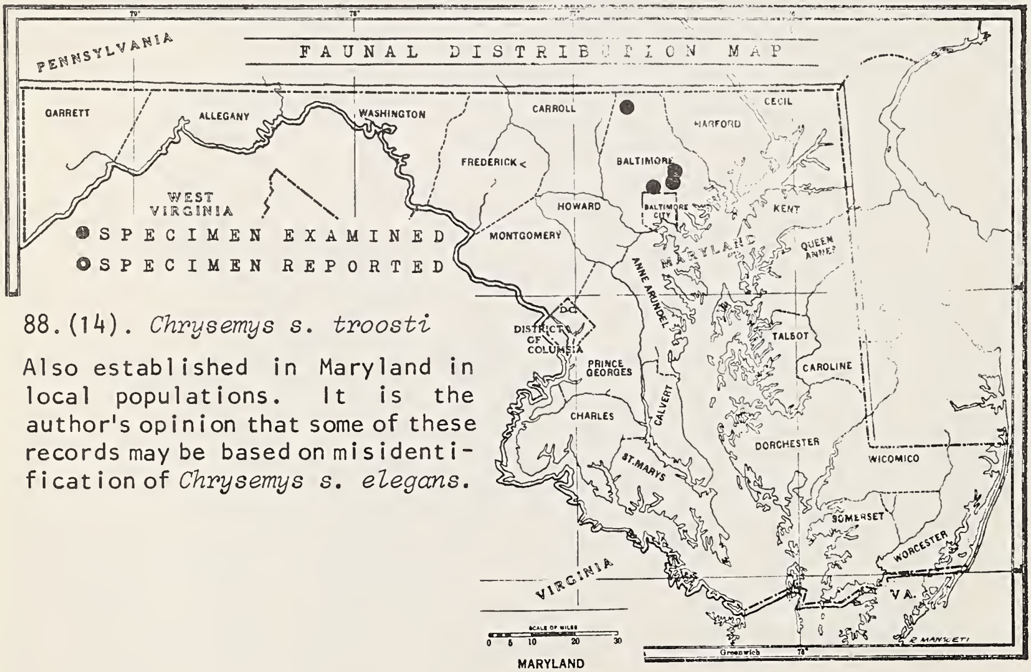
86.(12). *Chrysemys rubriventris*

Present data indicates this species to be Coastal Plain in distribution with encroachment in the Piedmont and Appalachian Provinces via lowland river valleys.



87.(13). *Chrysemys s. elegans* (Feral)

Has become established in Maryland in local populations.

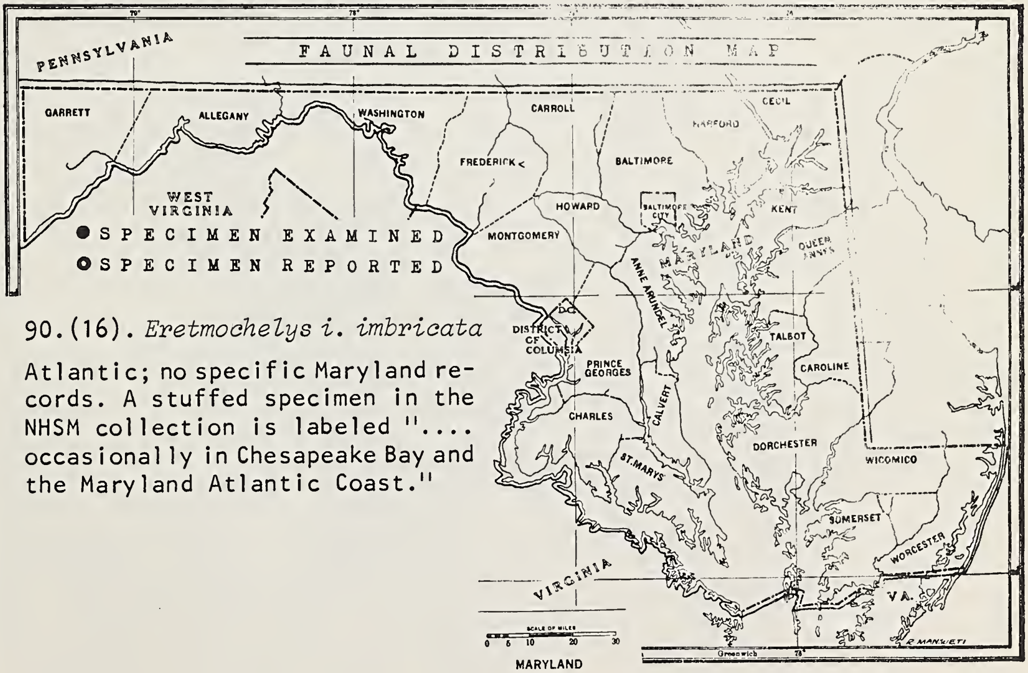


88.(14). *Chrysemys s. troosti*

Also established in Maryland in local populations. It is the author's opinion that some of these records may be based on misidentification of *Chrysemys s. elegans*.

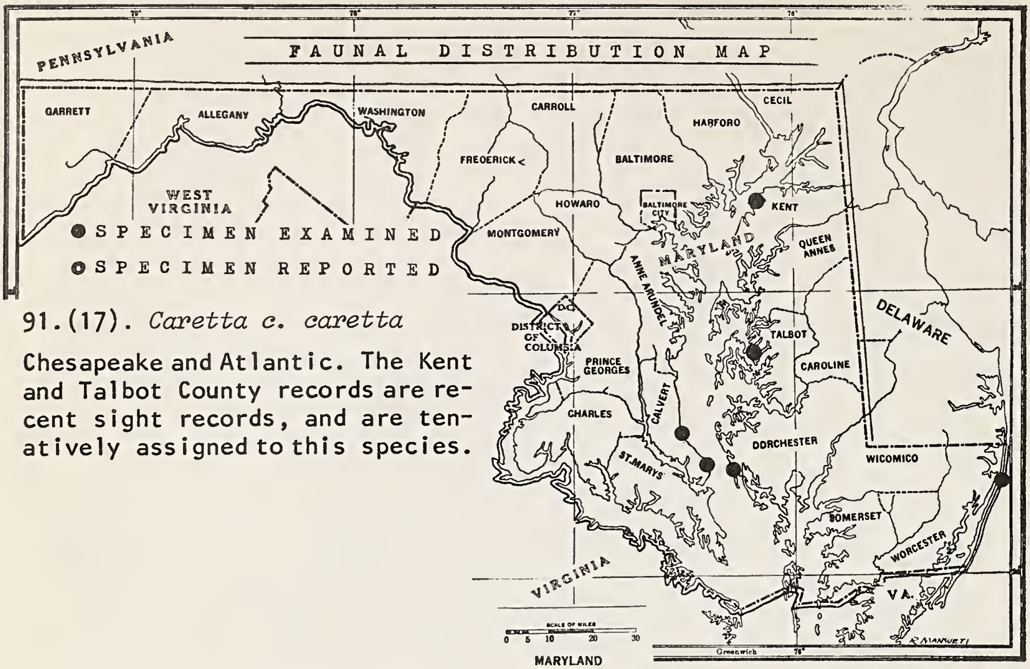
89.(15). *Chelonia m. mydas*

Chesapeake and Atlantic.



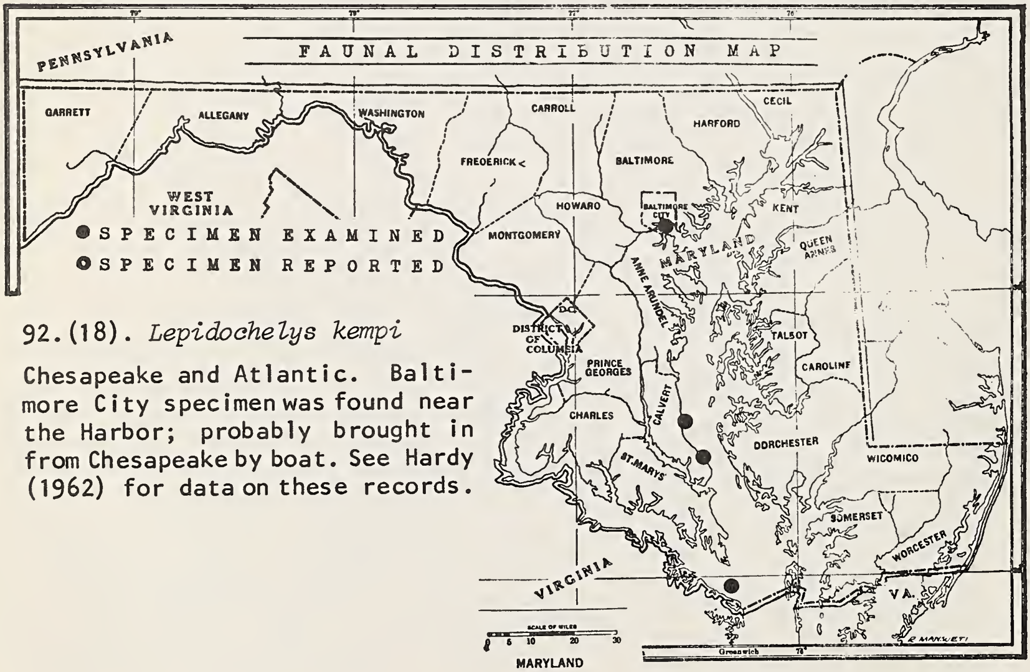
90.(16). *Eretmochelys i. imbricata*

Atlantic; no specific Maryland records. A stuffed specimen in the NHSM collection is labeled ".... occasionally in Chesapeake Bay and the Maryland Atlantic Coast."



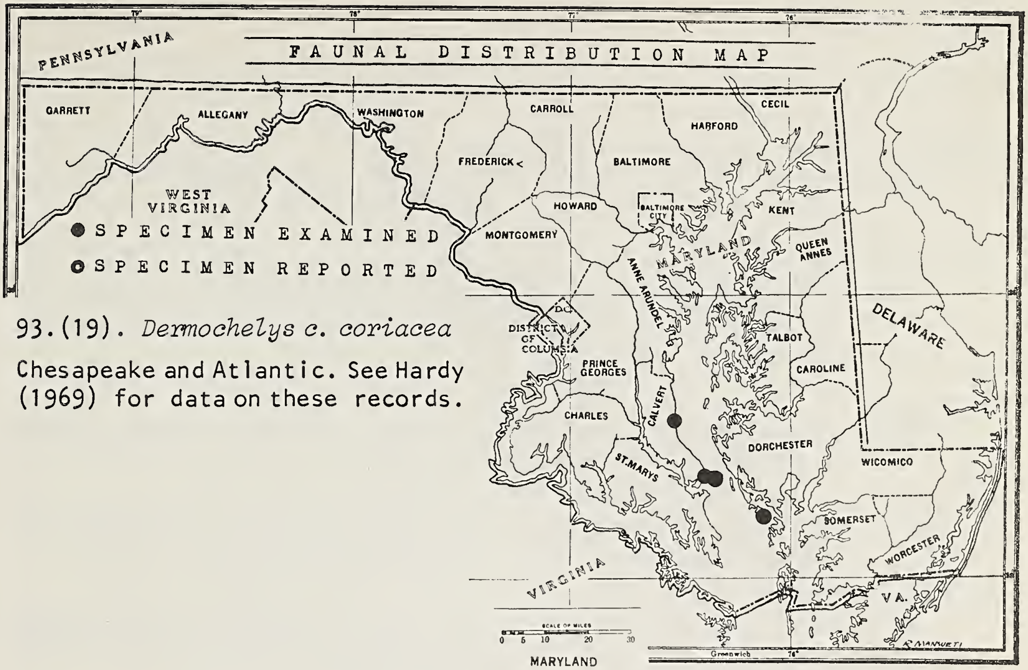
91.(17). *Caretta c. caretta*

Chesapeake and Atlantic. The Kent and Talbot County records are recent sight records, and are tentatively assigned to this species.



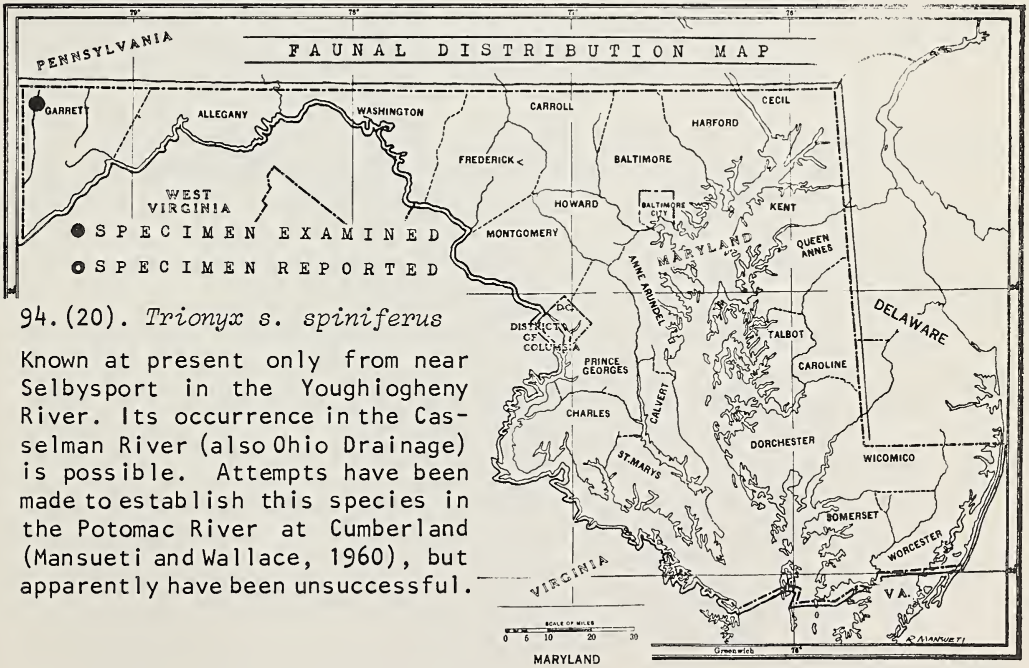
92.(18). *Lepidochelys kempi*

Chesapeake and Atlantic. Baltimore City specimen was found near the Harbor; probably brought in from Chesapeake by boat. See Hardy (1962) for data on these records.



93.(19). *Dermochelys c. coriacea*

Chesapeake and Atlantic. See Hardy (1969) for data on these records.



94.(20). *Trionyx s. spiniferus*

Known at present only from near Selbysport in the Youghiogheny River. Its occurrence in the Casselman River (also Ohio Drainage) is possible. Attempts have been made to establish this species in the Potomac River at Cumberland (Mansueti and Wallace, 1960), but apparently have been unsuccessful.

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Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each.

The Society also publishes a Newsletter on a somewhat irregular basis. These are distributed to the membership free of charge. Also published are Maryland Herpetofauna Leaflets and these are available at $.05/page.

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The Maryland Herpetological Society
Department of Herpetology
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BULLETIN OF THE MARYLAND HERPETOLOGICAL SOCIETY

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TAXONOMIC CHAOS: *Elaphe Guttata* (LINNAEUS), A CASE IN POINT

Robert A. Thomas

When Catesby (1754) described the snake *Anguis e rubro et albo varius*, one of the most perplexing nomenclatoral problems in North American herpetology began. Linnaeus (1766) applied the appellation *Coluber guttatus* to an example of the latter which had been sent to him from "Charleston, South Carolina," by Dr. A. Garden. By the early nineteenth century, numerous junior synonyms appeared under the species names *maculatus* (Bonnaterre, 1790), *compressus* (Donndorff, 1798), *carolinianus* (Shaw, 1802), and *molossus* and *panterinus* (Daudin, 1803).

Shaw's (1802) description of *C. carolinianus* was based on Plate 55 of Catesby's (1754) publication, though Shaw then discussed *C. guttatus* and noted that it was described by Catesby (1754).

Merrem (1820) recognized only *guttatus*, *maculatus*, and *pantherinus* and placed them in the genus *Natrix* Laurenti, 1768, with no explanation. He may have been led to this decision by Shaw's (1802: 460-61) statement (referring to *C. carolinianus*, which Merrem, 1820, considered a synonym of *C. maculatus*) that "Its habit or general form resembles that of the *Natrix* . . . ."

Harlan (1927) added to the confusion by describing *Coluber floridanus* from eastern Florida. Holbrook (1834) attempted to order matters by placing all of the aforementioned species in the synonymy of *C. guttatus*.

Baird and Girard (1853) were the first to note the singularity of the North American ratsnakes by describing the genus *Scotophis*, which included, in addition to the Linnaean *guttatus* and other species, the similarly patterned species *S. laetus* and *S. emoryi*. Duméril and Bibron (1854) noted the relationships of the North American *Scotophis* to the European ratsnakes by placing them all in the genus *Elaphis* Bonaparte, 1831. They also described *Elaphis rubiceps* (p. 270), which was considered a synonym of *C. guttatus* by Boulenger (1894), of *C. obsoletus confinis* by Cope (1875), and of *Elaphe vulpina* by Conant (1940) and Schmidt (1953). Jean Guibe (pers. comm.) has informed me that the holotype of *E. rubiceps* is lost, so its identity will remain a mystery.

Kennicott (1859), convinced that Harlan (1827) had specimens of what we now call *Elaphe guttata emoryi* before him when he described *Coluber calligaster*, relegated the species to the genus *Scotophis*. Cope (1860) realized that Kennicott's *S. calligaster* was based on snakes obviously distinct from *C. calligaster* Harlan and proposed the name *C. rhinomegas* for the former to avoid the confusion which might result from sympatric, similarly patterned snakes having the same trivial name.

Cope (1875) placed *Scotophis guttatus* and *S. emoryi* in the genus *Coluber* again and referred *S. calligaster* and *C. rhinomegas* to the synonymy of the latter.

In two major treatments on the Nearctic herpetofauna, Garman (1883) considered *Scotophis vulpinus* Baird and Girard a variety of *Elaphis guttatus* and Cope (1887) placed *S. emoryi* in the genus *Natrix* with reference to his (1862) emendation that Laurenti's (1768) original use of this genus should be followed.

Cope (1888a) described *Coluber rosaceus* and *C. g. sellatus* and subsequently (1888b) returned *Scotophis emori* to the genus *Coluber*.

Bonaparte's (1840) description of the genus *Callopeltis*, with *Coluber leopardina* as the type species, led to a number of referrals of North American ratsnakes to this genus (*e.g.*, Loennberg, 1895; Gibbs, *et. al.*, 1905; Strecker, 1915).

Boulenger (1894) erred in his treatment of the names of North American ratsnakes by describing with perfection a specimen of *Scotophis emoryi* under the appellation *Coluber laetus* (Baird and Girard) and by placing the name *C. emoryi* in the synonymy of *C. guttatus*. Despite Cope's (1900) decision to recognize *C. laetus* and *C. emoryi* as distinct species, the aforementioned designation of the Great Plains ratsnakes (*laetus*) was followed by Stejneger and Barbour (1917) under the genus *Elaphe* Fitzinger, 1833 (*in* Wagler, 1828-1833), with *S. emoryi* being placed in its synonymy. This nomenclatorial mistake was perpetuated until Dowling (1951a) exhibited the conspecificity of the holotype of *S. laetus* and *Elaphe obsoleta* (*auct.*) and referred the names *S. laetus* to the synonymy of *Elaphe obsoleta* and *E. laeta* to the synonymy of *E. emoryi*. He pointed out that the type of *S. laetus* is a juvenile (45.7 cm in total length) and that young *E. obsoleta* are very similar to *E. emoryi*. The following year, Dowling (1952) designated *emoryi* a subspecies of *E. guttata*.

Boulenger (1894) considered *Coluber g. sellatus* invalid and referred it to the synonymy of *C. guttatus*. Dunn (1915) and Barbour (1920) relegated *guttatus* and *rosaceus*, respectively, to the genus *Elaphe*.

Woodbury and Woodbury (1942) were the first to investigate relationships among several populations of *Elaphe guttata emoryi* (*auct.*). After examing the number of dorsal blotches, ventral scales, and subcaudal scales, they concluded that the isolated population in Utah and western Colorado represents a distinct race, *E. laeta intermontanus*. Dowling (1951a,b) placed this form in the synonymy of *E. guttata emoryi*.

Burt (1946) presented a description of *Elaphe quivira* (based on a specimen of *E. g. emoryi*) in an oral paper at the Kansas Academy of Sciences annual meeting of that year. Due to the publication of the name in a title with no subsequent description of the species, it is a *nomen nudum*.

When Cope (1888a) described *Coluber rosaceus*, he considered it as intermediate between *Coluber guttatus* and *C. quadrivittatus* (=*Elaphe obsoleta quadrivittata*). Carr (1940) considered its affinites to lie with the latter, though he gave no supporting evidence. Neill (1949) was the first to reduce *Elaphe rosacea* to subspecific status in *E. guttata* (this was overlooked by Dowling, 1952). In so doing, Neill noted that "Specimens

of *guttata* decidedly resembling *rosacea* are occasionally found even in northern Florida, and are common in South Florida." Dowling (1951b) stated that "should future study prove the variation to be a straight cline, then *E. guttata rosacea* would become a synonymy [sic] of *E. g. guttata*." Duellman and Schwartz (1958) demonstrated such clines and placed *E. g. rosacea* in *E. g. guttata's* synonymy. Paulson (1966) stated that his "subjective interpretation of the situation is that more is to be gained by the maintenance of the names *rosacea* . . . . .", as I have quoted and all authors to date have done so.

Since 1966, the "can of worms" has been closed, but it will soon be reopened!

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A Hybrid *Eumeces* from Oklahoma

On 26 June 1975, a female *Eumeces sp.* was collected by Beth Hillis in Osage Hills State Park, Osage County, Oklahoma. It was found coiled around twelve eggs in a sandy depression under a slab of sandstone, which lay on a steep hill near the shore of a lake. The eggs measured 11.5-12.5 mm by 8 mm and the adult 142 mm (133 mm total length, 70 mm snout-vent length in preservative). The eggs were maintained at 27° C until hatching (21 July).

The adult female has the general appearance of *E. anthracinus pluvialis*. The dark lateral stripe tapers from 4 to 2½ scales wide and the dorsolateral light stripe is on the edges of the third and fourth scale rows. There are two postmentals (anterior divided) on this specimen. In individuals of *E. a. pluvialis* only one postmental is characteristic and in *E. septentrionalis obtusirostris* and *E. fasciatus* there are generally two (Conant, 1975). In addition, a postnasal is present, characteristic of *E. fasciatus*, but not *E. a. pluvialis* or *E. s. obtusirostris* (Webb, 1970). In *E. s. obtusirostris* the dark lateral stripe is never wider than two scale rows and the light dorsolateral stripe is on the fourth (or fourth and fifth) scale row.

The twelve hatchlings have the general appearance of young *E. fasciatus*. Each has five yellow stripes extending onto the head, with the median stripe bifurcating at base of head. These stripes are faint or absent from the young of both *E. a. pluvialis* (Conant, 1975) and *E. s. obtusirostris*. The postmentals of the hatchlings vary in number from one to two (table 1). The size at hatching is also indicative of *E. fasciatus*.

Table 1. Selected Meristic and Morphometric Data on a Brood of *Eumeces a. pluvialis* X *E. fasciatus* hatchlings.

Specimen Number	Total Length (mm)	Number of Postmentals	Location of light dorsolateral stripe (scale row(s))
1	54	2	3rd & 4th
2	57	1	3rd & 4th
3	53	1	3rd & 4th
4	57	1	3rd & 4th
5	55	1	
6	55	2 (anterior postmental very small and only extending halfway across chin)	3rd & 4th
7	56	1	3rd & 4th
8	53	2	3rd & 4th
9	57	2	3rd & 4th
10	54	2 (posterior postmental divided)	3rd & 4th
11	53	2 (posterior postmental divided)	3rd & 4th
12	54	1 (postmental with two small unconnected scales anterior)	3rd & 4th

The adult female appears to be a hybrid between *E. a. pluvialis* and *E. fasciatus*. The young could be offspring of this hybrid and a male of either the parent species, or possibly a sibling male hybrid. The adult and hatchling numbers one, seven and twelve have been deposited in the collection of the Natural History Society of Maryland (R1909 NHSM to R1912 NHSM). The remaining hatchlings are being maintained alive for further study.

E. a. pluvialis has not been previously reported from Osage County, although this locality is within the probable range of the species (Webb, 1970). The closest records are: Parthenia Park, Tulsa County, 64 km south of Osage Hills State Park; Heyburn Lake Recreational Area, Creek County, 80 km to the south-southwest; 3.2 km south of Peoria and 8.8 km southeast of Quapaw, Ottawa County, both of which are approximately 120 km to the east-northeast (Webb, 1970).

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Evidence of Climbing Ability by Western Fox Snakes (*Elaphe vulpina vulpina*)

The natural history of the western fox snake (*Elaphe vulpina vulpina*) is poorly known even though it is one of the more common snakes in the upper Midwest. This species has been considered terrestrial (Cochran and Goin, 1970, Schmidt and Davis, 1941; Wright and Wright, 1957) and is thus unlike the other U. S. species of *Elaphe* which are frequently arboreal. It is of considerable interest that we have observed fox snakes above ground level in our large (40' high) wooden barn (3.1 mi NNE of Hudson, Ill.). At 11:35 A.M. on 19 June 1975 an adult fox snake was observed exploring an English sparrow nest located near the top of the barn on a beam adjacent to the roof. Presumably the snake was hunting for eggs or young birds. The snake's movements made the nest unstable and consequently the snake and part of the nest fell to the haymow floor 21' 1" below. The snake did not seem injured and immediately upon sighting us, began to vibrate its tail. The beam on which the nest rested is a considerable distance (30' 6") above ground level. There is no slope or easy access to the nest but a few bales of straw were stored next to the wall. For most of its ascent the snake probably climbed vertically. Because of the great height this would seem difficult even for snakes adept at climbing. On three other occasions in prior summers we observed inactive adult fox snakes in a crevice near the top of a barn door 7' 10" above ground.

These observations indicate that *E. v. vulpina* is quite capable of arboreal activity. The rarity of past observations of arboreal *E. v. vulpina* may be because they have been frequently seen in open, prairie-like situations where trees and shrubs are scarce. Perhaps a decrease in food resources due to heavy use of agricultural chemicals in central Illinois has exerted pressure on the snakes to search out greater prey concentrations by climbing in man-made elevated structures such as barns.

We thank R. S. Funk, D. Moll and J. Tucker for critically reading the ms.

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THE "CANNIBALS" OF THE TIGER SALAMANDER

One animal commonly sold by biological supply houses is the tiger salamander, *Ambystoma tigrinum* Green. In its larval stage occurs a rare aberrant, the "cannibal", which is little understood although obviously morphologically different (Fig. 1) when seen with others of its kind. The aberrant condition was noted by Powers (1903) and thoroughly discussed by him (1907). Since then, little has been written about it, largely because the animals are not common. In my personal collections only rare individuals (ten among thousands) show the effects of this way of life although there is ample evidence that cannibalism itself is a common occurrence in nature in this group. The differences seem to arise from dependence of the true cannibal upon other members of his species as a food source almost to the exclusion of any other, whereas other larvae indulge in cannibalism only as opportunity presents itself. The characters typical of the true cannibal are the (1) large overall size, (2) wide and depressed head, (3) extreme width between the orbits, (4) neoteny, and (5) extraordinary development of the lateral line system.

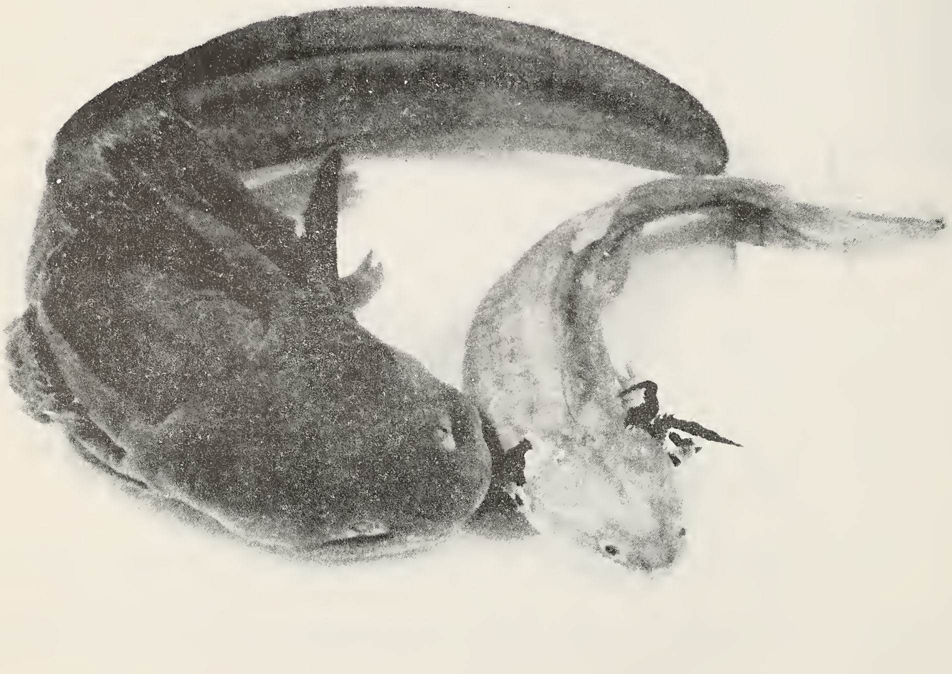

Fig. 1. RWR-131 (cannibal) and RWR-34 (normal).

Cannibalism does not hasten larval development in the tiger salamander as is the case in the spadefoot toad (Bragg, 1965), but on the contrary the developmental stage is prolonged. I have usually found cannibals in ponds containing neotenic populations. This, of course, assures a food supply of which they can take advantage the year around. I have also found them in the fall in ponds which contained larvae too small to transform, with the same result. With lack of food they will transform just as other larvae, with no apparent morphological differences as demonstrated by the measurements, taken two years after transformation, of UIMNH 78031 (Table 1), a cannibal which was allowed to transform. One difference observed by Powers (1907), and noted by Smith and Reese (1968) is that they seem to develop more frequently as males externally, but in two cases they were found to be females internally by the latter workers.

Table 1. Measurements of transformed adults that in the larvae stage were either "cannibal" or normal.

Specimen	Snout-vent mm	Tail mm	Head-width mm	Snout-vent/Head Ratio	Weight gms
UIMNH 78031 (Cannibal)	164.2	181.8	40.0	4.10	183.8
RWR 124 (Normal)	114.4	117.0	24.3	4.70	40.1
RWR 125 (Normal)	114.1	108.1	22.8	5.00	38.2
RWR 126 (Normal)	116.3	103.1	25.9	4.49	43.6

Comparison of the snout-vent to head-width ratio emphasizes the differences between the normal larvae and the cannibal forms. The average ratio for three cannibalistic examples (Table 2) is 2.79 as compared with 3.59 for three normal examples. An additional contrast exists in weight; the average for the normal animals is considerably less than that of the smallest cannibal. It should be noted here that RWR 131 is considered to be the largest known transformed or adult *Ambystoma tigrinum* in bulk as opposed to UIMNH 78031 which in length is the largest known.

Powers (1907) makes a number of generalizations relative to cannibalism, some but not all confirmed by my own observations. The cause is not genetic; the scarcity of the animal, the limited environment in which it is found and the readiness with which any individual preys upon smaller ones in the laboratory indicate that this may be true. They occur most frequently in clear water; I have found only a single specimen in muddy waters with the remainder taken in clear ponds containing a fairly heavy growth of water weeds. Powers (1907) further states that their growth is rapid, within a few weeks doubling the size of other larvae of the

Table 2. Measurements of cannibal and normal larvae.

Cannibal	Snout-vent mm	Tail mm	Head-width mm	Snout-vent/Head Ratio	Weight gms
RWR 131	145.0	146.0	56.7	2.56	333.5
UCM 33276	130.8	144.2	43.3	3.02	114.5
UCM 36107	136.0	*	48.9	2.78	151.0
Normal					
RWR 40	110.0	117.0	33.3	3.30	77.2
RWR 41	114.0	104.4	30.2	3.77	62.1
RWR 34	114.2	92.7	30.8	3.71	88.6

* Tail missing

same year. This I was partially able to confirm in one pond which permitted limited observations of the development of cannibalism. Although he describes them to be emaciated and undernourished in appearance, I did not find this to be the case in my specimens, which with one exception were well fed and fat. As a correlation with this last item, Powers (1907) also claims the forelimbs to be larger than the posterior limbs and hypothesizes that this is a result of all nutritive intake being absorbed by the anterior portion of the body. None of my specimens support either the observation or the hypothesis.

Uhlenhuth (1920), working with transformed animals, was concerned with the large size attained and thought on the basis of extirpation and grafting experiments with the anterior lobe of the hypophysis that the hormonal intake influenced the size. He fed anterior lobe of the hypophysis to transformed adults of *Ambystoma opacum* Gravenhorst and *Ambystoma tigrinum*. His controls were fed what was considered to be a normal diet, earthworms. The results obtained were interpreted as positive since the rate of growth was accelerated in those animals fed anterior lobe whereas the controls grew at what was considered to be a normal rate. The experimental animals continued to grow after reaching the normal "maximum" size for the species and indeed exceeded in size the largest specimen then known of the species. Of course, this "maximum" size is not significant since ectotherms grow continously, although at decreasing rates, throughout their lives. Therefore the "maximum" size is artificial. Uhlenhuth (1920), in experimenting with transformed animals, was not dealing with true cannibals, but he was creating giants as implied in the title of his paper.

Powers (1907) attributes the abnormal development of the head to the extreme, repetitive stretching of the mouth, as a strictly phenotypic response resulting in attainment of an adaptive development. The gape of the mouth does embrace the full width of the head in the cannibal, whereas

the normal animal has a gape only slightly wider than the spacing of the orbits.

An additional observation not noted by Powers (1903, 1907) is the extraordinary development of the lateral line system (Fig. 2) which is not found in normal larvae. All cannibalistic specimens examined by me exhibited this extreme development.

Fig. 2. Lateral Line system of RWR-131.

However, no truly satisfactory, convincingly documented explanation has been advanced for the occurrence of this phenomenon. Lloyd (1968), investigating flour beetles, *Tribolium* sp., has suggested that cannibalism is a method for self regulation of numbers. The idea could well be at least a byproduct in *Ambystoma tigrinum*, as eggs are frequently laid in larger numbers than a pond can support, and hatching is successful to a high degree, but these animals are more often the predators in a pond rather than the prey, and cannibalism among them is characteristically opportunistic.

That cannibalism starts at an early stage and at a relatively small size has been conclusively demonstrated in my studies of the animal. The problems are to determine (1) what causes an animal to retain this habit when their fellow larvae have dwindled in numbers to a point where other prey could much more easily be sought, (2) why the extraordinary unique

structural features of true cannibals develop, and (3) why the cannibals become and remain neotenic.

The abbreviations denoting collections utilized in this study represent the following collections: RWR - personal collection of R. W. Reese, UCM - University of Colorado Museum and UIMNH - University of Illinois Museum of Natural History.

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—Robert W. Reese, *Department of Biology, St. Edwards University, Austin, Texas 78704.*

Received 24 September 1975

Accepted 26 October 1975

A New County Record For *Gastrophryne carolinensis* In Maryland

At the time of addition to the Maryland endangered species list (CREARM, 1973), the eastern narrow-mouthed toad, *Gastrophryne carolinensis*, was known from four localities in Maryland: near Great Mills, St. Mary's County; Taylor's Island, Dorchester County; and Cove Point and near Solomons, Calvert County (Harris, 1969). It is thought that *G. carolinensis* has been extricated from the Calvert County localities (CREARM, 1973). Since, the narrow-mouthed toad has been recorded in Somerset County, (Lee, 1973) and at a second locality in Dorchester County (Harris, 1975).

Fig. 1. *Gastrophryne carolinensis* from Worchestor County, Md.

On 9 September 1975, Ed Lyon and I observed a newly metamorphosed *Gastrophryne carolinensis* 1.5 mi north of route 12 on Mount Olive Church Road in Worchestor County. On 11 September a second juvenile *Gastrophryne* was found hiding under a large piece of tarpaper at this site. The specimens were photographed at the time of observation for identification records, and one specimen is illustrated in Figure 1.

This locality, which represents a county record for Worchestor County, was included in the Distributional Survey (Amphibia/Reptilia): Maryland and the District of Columbia (Harris, 1975).

The habitat in which these specimens were found consists of a narrow strip of woodland seperating two farms. The frogs were apparently breeding in the drainage ditches that border the farms. The following additional species were also recorded at this locality: *Bufo w. fowleri, Bufo a. americanus, Scaphiopus h. holbrooki, Hyla chrysoscelis, Ambystoma opacum, Eumeces fasciatus, Sceloporus u. hyacinthinus, Coluber c. constrictor, Diadophis punctatus ssp., Heterodon platyrhinos, and Lampropeltis g. getulus.*

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—Richard Czarnowsky, *Box 262, M.S.U., Salisbury State College, Salisbury, Maryland 21801.*

Received 10 October 1975

Accepted 26 October 1975

A Brood of Arizona Ridge-nosed Rattlesnakes (*Crotalus willardi willardi*) Bred and Born in Captivity

INTRODUCTION

Reproductive data for the ridge-nosed rattlesnake (*Crotalus willardi*) is scant in the literature. Almost all has been cited by Klauber (1949, 1972). Klauber (1949) noted one specimen of *C. w. willardi* that contained 6 eggs, and one *C. w. silus* that had 2 well-developed embryos. In his 1972 monograph he recorded an additional brood of 9 for *C. w. willardi*. Klauber averaged the measurements of juveniles captured in the wild and concluded that they represented the approximate size of this species at birth. Recently, Martin (1975) reported data on a brood of 6 *C. w. willardi* born 18 August 1975 from a gravid female captured on 3 August 1975. No additional data on the reproductive habits of this species is available.

MATERIALS AND METHODS

Two immature specimens of the Arizona ridge-nosed rattlesnake (*Crotalus w. willardi*) were collected in the Santa Rita Mountains, Santa Cruz County, Arizona, and were raised to adulthood in a 10 gallon aquarium. Until the winter months of 1974-75 they were maintained between 18 and 31° C throughout the year. On 28 July 1974 the pair was observed in coitus for the first time. No other courtship or mating activities were observed. As the male was still rather small, it is possible that it may have just reached sexual maturity.

From late November 1974 through March 1975, the snakes were housed in a darkened room and kept between 4-15° C. Some daylight was allowed to penetrate the room to provide the winter photoperiod. Although their water dish was kept filled, the pair were never offered food. They were observed periodically and usually found to be very inactive. Care was taken to disturb them as little as possible. In early April they were again maintained at warmer temperatures (18-31° C).

OBSERVATIONS

Both specimens began to feed readily within several days after being exposed to warm temperatures, but remained relatively inactive. Activity gradually increased and on 10 June the male molted for the first time since being warmed up, and likewise did the female on 16 June. The male was observed actively courting the female soon after she had shed, and they were found copulating during the night. Courtship and mating activities were similar to the description for the genus *Crotalus* given by Klauber (1972).

On the morning of 10 September 1975 the female gave birth to six live offspring (Figures 1, 2) along with two yellow egg-like objects. The female and young were weighed on a Torsion Balance the same day and the young were measured after their first molt between September 21-23. Total lengths and weights of the six offspring and the female are presented in Table 1.

Figure 1. The female *Crotalus w. willardi* with her six one day old offspring.

Table 1. Total lengths and weights of a female *Crotalus willardi willardi* and her six young.

	Approximate length (nearest 5 mm)	Weight (gm)
Female:	570 (nearest 10 mm); (after parturition)	116.8 (after parturition)
Young:	200 (after first molt)	6.89 (day born)
	195 " " "	6.76 " "
	190 " " "	6.53 " "
	190 " " "	6.48 " "
	180 " " "	5.57 " "
	175 " " "	4.32 " "

Weights, sizes, coloration and markings of the juveniles agree with those described by Martin (1975). All were distinctly grey in coloration, and only two had the bright yellow tails conspicuous in the brood reported by Martin (1975). The other young had grey striped tails characteristic of the subspecies (Klauber, 1949).

After parturition the weight of the female was considerably greater than that of a wild caught gravid specimen (116.8 gm compared to 65.2 gm) although there was not a great difference in the size of the individuals (ca. 570 mm compared to 530 mm). This is probably due to the captive female having a constant food supply and not having to expend energy in search of prey.

Most of the offspring fed on lizards (*Urosaurus*) and newborn mice within several weeks of birth.

Figure 2. One day old *Crotalus w. willardi*. Note the light colored (yellow) tail.

DISCUSSION AND CONCLUSIONS

It is unfortunately not possible to determine which mating produced the brood. Klauber (1972) estimates 5 months as being the average gestation period for many rattlesnakes bred at the San Diego Zoo. It would then seem unlikely that the June 1975 mating was responsible, as a period of less than 3 months passed. However, if the July 1974 mating produced the brood, the gestation period would have totaled over 13 months. It is possible that the pair may have mated unobserved on other dates. Although observed daily before and after the winter months of 1974-75, it was during this period that as much as one week would pass that they were not checked. The fact that the snakes were exposed to a cooled environment during the winter preceding the birth cannot at this time be determined as influential.

The dates and events of this reproductive record does not necessarily correlate to what might be normal for the species in nature.

ACKNOWLEDGEMENTS

I am most grateful to Dr. Howard K. Gloyd at the University of Arizona for his guidance and advice in the preparation of this manuscript. I also thank Dr. Mac E. Hadley for the use of the facilities in his laboratory at the University.

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—Brent E. Martin, *704 North Second Avenue, Tucson, Arizona 85705.*

Received 5 November 1975

Accepted 21 November 1975

News & Notes

LIMITED OFFER --- 40% OFF PUBLISHER'S LIST PRICE

THE HYLID FROGS OF MIDDLE AMERICA

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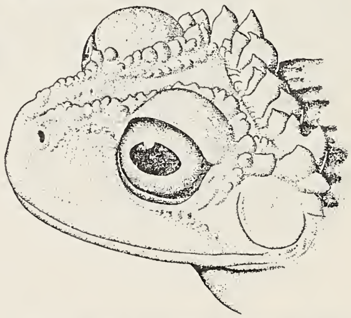

FIG. 54. Head of *Anotheca spinosa* (K.U. No. 58076) showing extreme condition of cranial spines. × 3.

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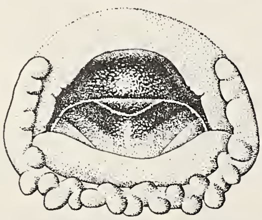

Fig. 99. Mouth of tadpole of *Hyla subocularis*, K.U. No. 116784. × 45.

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zip code

MARCH 1976 ESHL MEETING

The Eastern Seaboard Herpetological League will hold its March 1976 meeting in Philadelphia. Please plan now to attend. See below for details.

DATE - March 6, 1976

TIME - 12:00 Noon

PLACE - Rohm & Haas Building Auditorium
Independence Mall West
6th and Market Streets
Philadelphia, Pennsylvania

With this being the Bicentenial year, you may wish to plan on staying several days to take in the exhibits. Please do plan early!

If you would like to present a paper at the March ESHL meeting, write to Malvin L. Skaroff, 1025 Lakeside Avenue, Philadelphia, Pa. 19126.

Errata: Distributional Survey (Amphibia/Reptilia): Maryland and the District of Columbia. *Bull. Md. Herp. Soc. 11*(3):73-170.

Page 75, Paragraph 1, Line 2: relict = disjunct
Page 75, Paragraph 2, Line 3: dilgently = diligently
Page 75, Paragraph 3, Line 2: fluxuations = fluctuations
Page 75, Paragraph 3, Line 4: virituely = virtually
Page 76, Paragraph 1, Line 1: vain = vein
Page 76, Paragraph 1, Line 3: *syspilla* = *syspila*
Page 76, Paragraph 2, Lines 4, 9: Susquehana = Susquehanna
Page 77, Paragraph 1, Line 6: (1960) = (1970)
Page 78, No. 46,58: Tenative = Tentative
Page 79, bottom: *melanolecus* = *melanoleucus*
Page 80, *E. g. guttolineata* account: occuring = occurring
Page 81, Paragraph 3, Lines 1,6: MaCauley = McCauley
Page 81, Paragraph 4, Line 3: legimate = legitimate
Page 81, Paragraph 4, Line 12: respectfully = respectively
Page 81, Paragraph 4, Line 14: legimate = legitimate
Page 81, Paragraph 5, Line 1: legimate = legitimate
Page 81, Paragraph 5, Line 3: tenatively = tentatively
Page 82, Table 1: *R. u. ultricularia* = *R. u. utricularia*
Page 83, Table 2: *R. u. ultricularia* = *R. u. utricularia*
Page 88, Map 1, Lines 9,10: becomming = becoming
Page 95, Map 16, Line 2: encroachs = encroaches
Page 98, Map 21, Line 4: labled = labeled
Page 101, Maps 28/29, Lines 5,11: *H. chrysoselis* = *H. chrysoscelis*
Page 102, Map 30, Line 8: waters = water's
Page 105, Map 37, Line 4: authenic = authentic
Page 105, Map 37, Line 5: *pipens* = *pipiens*
Page 105, Map 37, Line 6: Ponds = Pons
Page 109, Map 44, Line 4: labled = labeled
Page 110, Map 46, Line 4: Davis = Davis (1968)
Page 110, Map 46, Line 18: tenative = tentative
Page 111, Map 48, Line 3: labled = labeled
Page 116, Map 58, Line 10: tenative = tentative
Page 117, Map 61, Lines 3,9: *L. d. temporalis* = *L. t. temporalis*
Page 118, Map 62, Line 2: *L. d. triangulum* = *L. t. triangulum*
Page 119, Map 64, Line 4: (Cooper, 1970) = (Cooper, 1969)
Page 120, Map 66, Line 1: thru = through
Page 120, Map 66, Line 9: Mansuetti = Mansueti
Page 121, Map 68, Lines 6,7: occassional = occasional
Page 124, Map 74, Line 13: (Cooper, 1959) = (Cooper and Groves, 1959)
Page 124, Map 74, Line 15: (Agnes, 1972) = (tropical storm Agnes in 1972)
Page 125, Map 76, Line 2: should read......Eastern and Western Piedmont, and Blue Ridge Province via....
Page 129, Maps 84/85, Line 11: tenatively = tentatively
Page 130, Map 88: insert (Feral) under *Chrysemys* (as in Map 87.(13).)
Page 132, Map 91, Lines 3,4: tenatively = tentatively
Page 134: Literature Cited = Bibliography
Page 138: reference 6: _____. = _____. and F. Groves (this should be listed after 3rd reference on page 139)
Page 139, reference 12: C. B. Brimley = C. S. Brimley
Page 149, reference 13: Aufrey = Audrey
Page 150, reference 3: Lamay = Lemay
Page 153, reference 11: idenity = identity
Page 160, reference 15: Schreiger = Schreiber
Page 161, reference 5: Captians = Captains
Page 161, reference 10: Handbood = Handbook

Due to printing deadlines, final proofs were not examined thoroughly and many errors resulted. I apologize for this inconvenience. Please paste this sheet on page 167 of your copy Vol. 11 No. 3.

H.S.H.

NOTES

Society Publications

Back issues of the Bulletin of the Maryland Herpetological Society, where available, may be obtained by writing the Executive Editor. A list of available issues will be sent upon request. Individual numbers in stock are $2.00 each, unless otherwise noted.

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All correspondence should be addressed to the Executive Editor. Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8½ x 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at end in alphabetical order by author.

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